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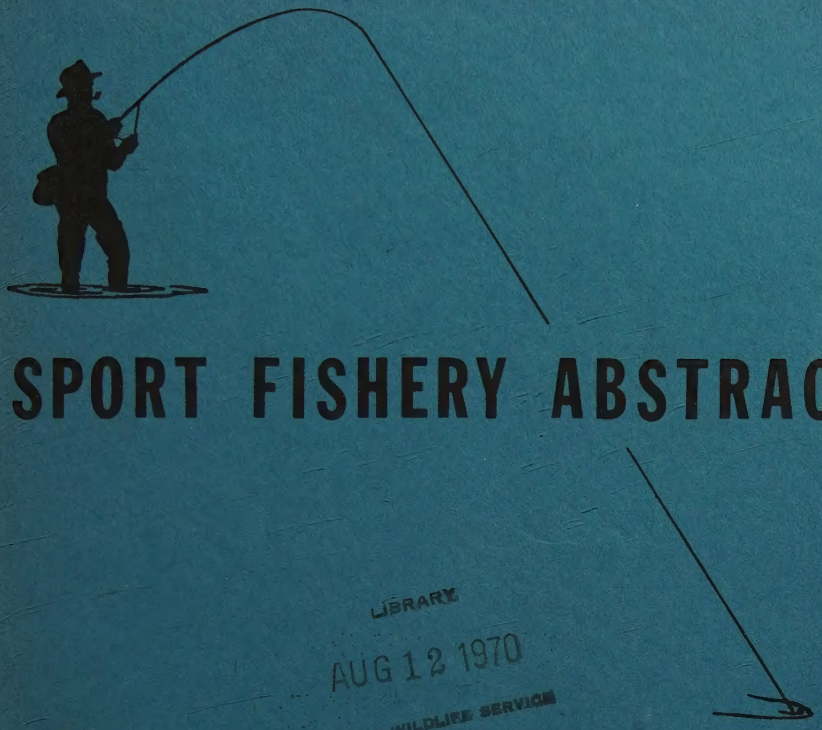

SPORT FISHERY ABSTRACTS

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DEPARTMENT OF THE INTERIOR
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BUREAU OF SPORT FISHERIES AND WILDLIFE

UNITED STATES DEPARTMENT OF THE INTERIOR

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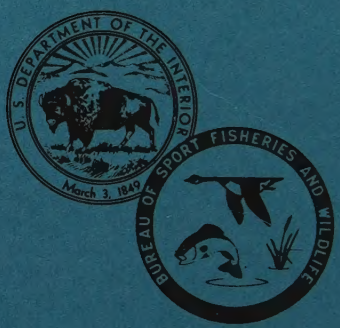

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Prepared in the Division of Fishery Research

Narragansett, Rhode Island

SPORT FISHERY ABSTRACTS

An abstracting service for fishery research and management

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Sport Fishery Abstracts is intended to furnish fishery biologists in government agencies and educational institutions with abstracts of the current literature in sport fishery research and management. Abstracts of published articles on limnology, ecology, natural history and other fields of specialization are included when the subject has application to the conservation and management of sport fishery resources.

One volume consisting of four numbers is issued each year. Each number contains separate Author and Subject indexes. The final number of each volume contains cumulative Author and Subject indexes and a list of publications screened.

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Editor's note: The preparation of Sport Fishery Abstracts has been transferred from Washington D. C. to Narragansett, Rhode Island. All correspondence should be directed to the address shown in the above block.

11251. Kempton, Rudolf T. (Dept. of Biology, Vassar College, Poughkeepsie, New York 12601). 1969. MORPHOLOGICAL FEATURES OF FUNCTIONAL SIGNIFICANCE IN THE GILLS OF THE SPINY DOGFISH. The Biological Bulletin, 136(2): 226-240.

11252. Wheeler, Alwyne (Dept. of Zoology, British Museum (Natural History), South Kensington, London, S. W. 7, England). 1969. FISH-LIFE AND POLLUTION IN THE LOWER THAMES: A REVIEW AND PRELIMINARY REPORT. Biological Conservation, 2(1): 25-30.

Commercial fisheries of considerable economic value existed in the tidal reaches of the River Thames, England, until the middle of the nineteenth century. Increasing pollution from industrial and domestic effluents led to their complete destruction and, in the twentieth century, to the virtual absence of a local fish fauna. Recent measures to control pollution have resulted in a partial chemical restoration of the River. Sampling in the lower Thames, by collecting fish caught on the cooling-water intake screens of five electricity generating stations along the River, has shown that fish are present in considerable numbers again. In the period from September 28, 1967 to October 31, 1968, forty-one species were taken. At the farthest upstream point, the majority of fish caught have been freshwater species, while at the farthest downstream station, with one exception, only marine or euryhaline species have been caught. This, and evidence that migratory fish have penetrated through the worst-polluted reaches into relatively clean water, is taken as an encouraging sign of the re-establishment of the fish fauna in the lower Thames. (Auth.)

11253. Campbell, James B., and Ken Wolf (The Wistar Inst. of Anatomy and Biology, Philadelphia, Pa. and the W. H. O. International Reference Centre for Rabies at the Wistar Inst., Philadelphia, Pa.). 1969. PLAQUE ASSAY AND SOME CHARACTERISTICS OF EGTVED VIRUS (VIRUS OF VIRAL HEMORRHAGIC SEPTICEMIA OF RAINBOW TROUT). Canadian Journal of Microbiology, 15(6): 635-637.

A plaque assay and some growth characteristics of Egtved virus in a line of rainbow trout cells (RTG-2) are described. Preliminary experiments with metabolic inhibitors suggest that the viral genome is ribonucleic acid. (Authors)

11254. Sutterlin, A. M., and R. L. Saunders (Fisheries Res. Board of Canada, Biological Station, St. Andrews, New Brunswick, Canada). 1969. PROPRIOCEPTORS IN THE GILLS OF TELEOSTS. Canadian Journal of Zoology, 47(6): 1209-1212.

Two groups of proprioceptors were found on the gills of the sea raven and Atlantic salmon. Receptors associated with the gill filaments respond to filament displacement and receptors located in the region of the gill rakers respond to displacement of the rakers. Branchial divisions of cranial nerves IX and X innervating the different gills contain both classes of receptor fibers. The size and properties of the receptive fields are described and possible physiological functions for the receptors are proposed. (Authors)

11255. Moshiri, Gerald A., and Kenneth W. Cummins (Pymatuning Laboratory of Ecology, Univ. of Pittsburgh). 1969. CALORIFIC VALUES FOR Leptodora kindtii Focke (CRUSTACEA, CLADOCERA) AND SELECTED FOOD ORGANISMS. Archiv für Hydrobiologie, 66(1): 91-99.

Caloric determinations were made on seven categories of Leptodora kindtii and 13 categories of food organisms using a Phillipson-type microbomb calorimeter. The values reported are generally higher than those previously reported in the literature for the same or similar species. Of the Leptodora categories tested, males showed the lowest and overwintering eggs the highest caloric content. Of all material combusted, the bacterium Escherichia intermedia yielded the lowest value. (Authors)

11256. Liley, N. R. (Dept. of Zoology, Univ. of British Columbia, Vancouver, British Columbia, Canada) and E. M. Donaldson. 1969. THE EFFECTS OF SALMON PITUITARY GONADOTROPIN ON THE OVARY AND THE SEXUAL BEHAVIOR OF THE FEMALE GUPPY, Poecilia reticulata. Canadian Journal of Zoology, 47(4): 569-573.

Ten hypophysectomized female guppies and ten hypophysectomized and gonadectomized females were treated with the partially purified gonadotropin fraction of the pituitary of pacific salmon. Control fish were hypophysectomized and given saline injections. It was found that salmon gonadotropin stimulates growth and maturation of the ovary in the guppy. The results also suggest that the gonadotropin stimulates the secretion of an ovarian hormone which is involved in the regulation of sexual behavior. The significance of an initial low level of sexual response in both gonadotropin-treated groups is discussed. (Authors)

11257. Paterson, C. G., and C. H. Fernando (Dept. of Biology, Univ. of Waterloo, Waterloo, Ontario, Canada). 1969. THE EFFECT OF WINTER DRAINAGE ON RESERVOIR BENTHIC FAUNA. Canadian Journal of Zoology, 47(4): 589-595.

Winter drainage of Laurel Creek Reservoir in southern Ontario exposed the benthic environment to atmospheric conditions for between 168 and 176 days. During the first 50 days, which had above-freezing temperatures, much of the fauna was destroyed. In the next 100 days the substrate became frozen to depths greater than 20 cm. Freezing of the substrate resulted in the loss of the oligochaetes, nematodes, and oribatoid mites as well as a large percentage of the chironomid fauna. Small numbers of the caddis fly, Agraylea multipunctata; the chironomid Cricotopus trifasciatus; and the molluscs Planorbula jenksii and Lymnaea palustris were found to survive the period of freezing and the subsequent short period of thawing before the refilling of the reservoir. Indirect evidence suggests the survival of small numbers of certain species of chironomids not found in the samples. Glyptotendipes barbipes showed the highest survival under the conditions of exposure, as the population immediately after refilling was between 12.5 and 46.4% of that found before drainage of the reservoir. The fauna did not actively move deeper into the substrate as freezing progressed although the probability of survival was greater at the deeper levels. A. multipunctata, C. trifasciatus, and G. barbipes have been found able to pupate and emerge after survival in the exposed substrate. (Authors)

11258. Rao, G. Madan Mohan (Dept. of Zoology, Univ. of Toronto, Toronto, Ontario, Canada). 1969. EFFECT OF ACTIVITY, SALINITY, AND TEMPERATURE ON PLASMA CONCENTRATIONS OF RAINBOW TROUT. Canadian Journal of Zoology, 47(1): 131-134.

The plasma of rainbow trout was essentially isosmatic with the medium in 7.5 °/oo salinity. Osmotic concentrations of plasma were higher by 5% to 12% in an exercised fish in all salinities at both temperatures when compared to those of a resting fish. However, the chloride concentrations of exercised and resting fishes were not significantly different. Both osmotic and chloride concentrations of plasma were higher at 5°C than those at 15°C. (Auth)

11259. Pandey, S. (Dept. of Zoology, Univ. of British Columbia, Vancouver, British Columbia, Canada). 1969. EFFECTS OF HYPOPHYSECTOMY ON THE TESTIS AND SECONDARY SEX CHARACTERS OF THE ADULT GUPPY Poecilia reticulata Peters. Canadian Journal of Zoology, 47(5): 775-781.

11260. Schmidt, Gerald D. (Dept. of Biology, Colorado State College, Greeley, Colorado). 1969. Paracanthocephalus rauschi sp. n. (ACANTHOCEPHALA: PARACANTHOCEPHALIDAE) FROM GRAYLING, Thymallus arcticus (Pallas), IN ALASKA. Canadian Journal of Zoology, 47(3): 383-385.

Paracanthocephalus rauschi sp. n. is described from grayling, Thymallus arcticus, and incidentally in otter, Lutra canadensis, from Alaska. It is most similar to P. tenuirostris Achmerov and Dombrovskaja-Achmerova, 1941, differing from it in having eggs 65-88 microns long rather than 40-41 microns long, and hooks on the female up to 167 microns long rather than up to 119 microns long. A key to the species in Paracanthocephalus is included. (Auth.)

11261. Tedla, Shibru, and C. H. Fernando (Dept. of Biology, Univ. of Waterloo, Waterloo, Ontario, Canada). 1969. OBSERVATIONS ON THE BIOLOGY OF Ergasilus spp. (CYCLOPOIDEA: COPEPODA) INFESTING NORTH AMERICAN FRESHWATER FISHES. Canadian Journal of Zoology, 47(3): 405-408.

The gills of 18 yellow perch, Perca flavescens; 18 pumpkinseed, Lepomis gibbosus; 14 rock bass, Ambloplites rupestris; and 15 smallmouth bass, Micropterus dolomieui, were examined for Ergasilus spp. Ergasilus caeruleus was recovered from pumpkinseed and E. confusus from yellow perch. Rock bass and smallmouth bass were infested with E. centrarchidarum and one immature specimen of this species was recovered from a pumpkinseed. The host preference of each parasite species is discussed. A relationship between the egg number of copepods with more than one host and the degree of host preference is suggested. (Authors)

11262. Eales, J. G. (Dept. of Biology, Univ. of New Brunswick, New Brunswick, Canada). 1969. IN VIVO UPTAKE OF RADIOTHYROXINE BY THE TISSUES OF ATLANTIC SALMON (Salmo salar L.) PARR, PRESMOLT, AND SMOLT. Canadian Journal of Zoology, 47(1): 9-16.

Tissue uptake of radiothyroxine in Atlantic salmon parr, presmolts, and smolts held at 10.5 to 13.5°C was assessed by measuring T/S ratios (tissue radioactivity/serum radioactivity) from 1 hour to 10 days after intraperitoneal injection of L-thyroxine-^{125}I. T/S ratios were highest for gall bladder, liver, and gut, indicating a biliary thyroxine excretion route. Somewhat less uptake occurred in spleen, kidney, and gill. T/S ratios were lower still for skin and muscle but the pattern of T/S change with time suggested some radiothyroxine uptake by these tissues. Little uptake occurred in the brain where low T/S ratios were consistently found. For most tissues there was no difference in thyroxine uptake between parr, smolts, and presmolts. However, for presmolts the means of gill T/S ratios were much higher than those for parr or smolts while the biliary thyroxine excretion route was most prominent in parr. The biological half-life of serum radioactivity after intraperitoneal injection of L-thyroxine-^{125}I was similar for parr, presmolt, and smolt. Most of the serum radioactivity was not protein-bound and was probably free radiothyroxine. The injected radiothyroxine may have so increased the serum free thyroxine pool that serum protein thyroxine-binding sites were saturated. (Auth.)

11263. McKenzie, J. A., and U. Paim (Dept. of Biology, Univ. of New Brunswick, Fredericton, New Brunswick, Canada). 1969. VARIATIONS IN THE PLASMA PROTEINS OF ATLANTIC SALMON (Salmo salar L.). Canadian Journal of Zoology, 47(5): 759-761.

The plasma proteins of 51 juvenile Atlantic salmon were examined by vertical acrylamide gel electrophoresis. Eight distinct phenotypes were found from specimens originating from a single river system in New Brunswick. The potential use of these polymorphisms for identifying populations is discussed. (Authors)

11264. Sheri, A. N. and G. Power (Dept. of Biology, Univ. of Waterloo, Waterloo, Ontario, Canada). 1969. FECUNDITY OF THE YELLOW PERCH, Perca flavescens Mitchill, IN THE BAY OF QUINTE, LAKE ONTARIO. Canadian Journal of Zoology, 47(1): 55-58.

The relationships between the logarithm of the number of ova shed by yellow perch in the Bay of Quinte and length, weight and age of the fish were found to be: Y=2.982 + 0.007X where X is length in millimeters; Y=3.769 + 0.004X where X is weight in grams; Y=3.780 + 0.098X where X is the age in completed years. The logarithm of the number of mature ova spawned = 4.082 + 0.003 multiplied by the ovary weight in grams. Individual fecundity ranged from 3,035 for a II+ fish, 135 mm, 27.2g to 61,465 for a VIII+ fish, 257 mm, 308.4g. (Authors)

11265. MacCrimmon, H. R., and Wen-Hwa Kwain (Dept. of Zoology, Univ. of Guelph, Guelph, Ontario, Canada). 1969. INFLUENCE OF LIGHT ON EARLY DEVELOPMENT AND MERISTIC CHARACTERS IN THE RAINBOW TROUT, Salmo gairdneri Richardson. Canadian Journal of Zoology, 47(4): 631-637.

Initial mortality of newly fertilized rainbow trout eggs incubated in artificial light increased with intensity. The mortality among eyed eggs exposed to the same set of conditions was comparatively low regardless of intensity. Mortality, time to hatch, metabolic rate, and the number of vertebrae formed correlated positively with visible light intensity but only during the pre-eyed stage of incubation. By contrast, the numbers of dorsal and anal fin rays were affected by light intensity during the post-eyed incubation period, the greatest number of rays on these fins occurring in fish incubated at light intensity of 10 lux. The numbers of pectoral and pelvic fin rays were constant at all test light intensities. Further research is imperative if the importance of light as an environmental factor in the early development of fish is to be understood. (Authors)

11266. Pandey, S. (Dept. of Zoology, Univ. of British Columbia, Vancouver, British Columbia, Canada). 1969. EFFECTS OF METHYL TESTOSTERONE ON THE TESTIS AND SECONDARY SEX CHARACTERS OF THE HYPOPHYSECTOMIZED ADULT GUPPY Poecilia reticulata Peters. Canadian Journal of Zoology, 47(5): 783-786.

Exogenous methyl testosterone appears to have a direct spermatokinetic effect on the testis of the hypophysectomized adult guppy. The gonosomatic index is significantly increased; spermatogonial cysts divide rapidly and transform into spermatocytes, but later stages of spermatogenesis do not appear. The regressed epithelial cells lining the sperm ducts, the Sertoli cells, and the interstitial cells resume their normal appearance. The gonopodium remains unaffected, but there is moderate recovery in the content of integumentary lipophores. (Auth.)

11267. Lam, T. J. (Dept. of Zoology, Univ. of British Columbia, Vancouver, British Columbia, Canada). 1969. EFFECT OF PROLACTIN ON LOSS OF SOLUTES VIA THE HEAD REGION OF THE EARLY-WINTER MARINE THREESPINE STICKLEBACK (Gasterosteus aculeatus L., form trachurus) IN FRESH WATER. Canadian Journal of Zoology, 47(5): 865-869.

Net loss of sodium chloride and ^{14}C-inulin (at least ^{14}C from injected ^{14}C-inulin) via the head region of the early-winter marine threespine stickleback (Gasterosteus aculeatus L., form trachurus) was studied in an apparatus which permits the suspension of a fish by a rubber diaphragm with its head (including the gills) in continuously oxygenated dechlorinated fresh water, and its trunk in paraffin oil. Under this condition, prolactin injections significantly reduced the net loss of the solutes. Despite this finding with regard to ^{14}C, the prolactin-injected fish showed a lower terminal plasma ^{14}C activity per microliter than the solvent-injected fish. The significance of these findings was discussed. (Auth.)

11268. Leatherland, J. F., and T. J. Lam (Dept. of Zoology, Univ. of British Columbia, Vancouver, British Columbia, Canada). 1969. EFFECT OF PROLACTIN ON THE DENSITY OF MUCOUS CELLS ON THE GILL FILAMENTS OF THE MARINE FORM (trachurus) OF THE THREESPINE STICKLEBACK, Gasterosteus aculeatus L. Canadian Journal of Zoology, 47(5): 787-792.

The density of the mucous cells on the gill filaments of the marine form (trachurus) of the threespine stickleback (Gasterosteus aculeatus L.) was investigated after changes of ambient salinity and intraperitoneal injection of ovine prolactin. Prolactin treatment appears to have no effect on the mucous cells of the seawater-adapted fish. Prolactin-treated fish showed a significantly higher density of gill mucous cells after 5 hours in fresh water when compared with solvent-injected controls. The differences among the prolactin-injected, solvent-injected, and uninjected groups were less marked after 1 and 4 days in fresh water. After 8 days in fresh water, however, the solvent-treated controls again had a significantly lower gill mucous cell density than their prolactin-treated contemporaries. The significance of these findings is discussed in relation to the osmotic and (or) ionic regulating properties of prolactin. (Authors)

11269. Hanek, George, and William Threlfall (Dept. of Biology, Memorial Univ. of Newfoundland, St. John's, Newfoundland, Canada). 1969. DIGENETIC TREMATODES FROM NEWFOUNDLAND, CANADA. 1. THREE SPECIES FROM Gasterosteus aculeatus Linnaeus, 1758, Canadian Journal of Zoology, 47(5): 793-794.

Three species of digenetic trematodes are recorded from the three-spined stickleback, Gasterosteus aculeatus Linnaeus, 1758, namely Podocotyle atomon (Rudolphi, 1802), Brachyphallus crenatus (Rudolphi, 1802), and Lecithaster gibbosus (Rudolphi, 1802). The latter two species are new host records for North America. (Authors)

11270. Cook, H., and A. P. vanOverbeeke (Dept. of Biological Sciences, Simon Fraser Univ., Burnaby, British Columbia, Canada). 1969. ULTRASTRUCTURE OF THE ETA CELLS IN THE PITUITARY GLAND OF ADULT MIGRATORY SOCKEYE SALMON (Oncorhynchus nerka). Canadian Journal of Zoology, 47(5): 937-941.

In the rostral pars distalis of the adult migratory sockeye salmon (Oncorhynchus nerka), most of the cells are arranged in follicles. The predominant cell type, the eta cell, contains secretory granules of 175-300 mμ in diameter; its endoplasmic reticulum shows a conspicuous lamellar organization. These cells undergo only slight changes as the fish migrate from the ocean to the spawning grounds. The findings are discussed in relation to the function of prolactin in euryhaline teleosts. (Authors)

11271. v. Sengbusch, R., B. Lühr, Ch. Meske, and W. Szablewski (Max-Planck-Institut für Kulturpflanzenzüchtung, Hamburg-Volksdorf, West Germany). 1967. THE REARING OF CARP FRY IN AQUARIA. (Aufzucht von Karpfenbrut in Aquarien). Archiv für Fischereiwissenschaft, 17(2): 89-94.

For the first time, it was possible to grow carp fry in aquaria by means of intensive rearing in warm water combined with biological water clearing. Carp, which were fed predominantly by prepared food, reached a weight of more than 1.5 kg. after one year. By this method it is possible to select quick growing carp after only a few weeks, to speed up all culturing experiments by means of a quick succession of generations, and to overwinter K_1 with a steady increase in weight. (Authors)

11272. Lillelund, K. (Institut für Hydrobiologie und Fischereiwissenschaft der Universität Hamburg, West Germany). 1967. EXPERIMENTS ON THE INCUBATION OF THE EGGS OF THE PIKE, Esox lucius L., IN RELATIONSHIP TO TEMPERATURE AND LIGHT. (Versuche zur Erbruntung der Eier vom Hecht, Esox lucius L., in Abhängigkeit von Temperatur und Licht). Archiv für Fischereiwissenschaft, 17(2): 95-112.

Eggs of the pike, Esox lucius, collected from mature fishes from several lakes, were reared at constant temperatures in the range of 3.7°C-24°C. The duration of development from fertilization to the eyed stage, hatching, "swimming-up" and dying, if not fed, was determined for individual stages of temperature. The ratio of the period of development from the eyed stage to hatching - to the period from fertilization to the eyed stage is higher the lower the water temperature. If the eggs are incubated at lower temperatures, the larvae will hatch at a more developed embryonic stage than at higher temperatures. The developmental period from fertilization to the eyed stage, from the eyed stage to swimming-up larvae, and from swimming-up larvae to death (if larvae are not fed) shows a constant ratio of nearly 1:2:2 in the pike, independent of the temperature. The number of day-degrees which is necessary to reach a specific embryonic stage increases exponentially with decreasing temperatures. The hatching rates in the range of 9-15°C are not influenced by temperature. At constant rearing temperatures of 18°C, 7-29% died, at 21°C, 66-81% died, and at 5.8°C, 40% of all eggs died which were conditioned to the temperature during the period of incubation. Temperature tolerance of the eggs increases rapidly after fertilization, when the yolk is grown over, although slowly. The upper temperature limit at which 50% of the eggs, conditioned during the incubation, die, when further incubation at this temperature is carried out, climbs from 19.8°C for the 2-4 cell stage up to 28°C for the incipient eyed stage. Experimental daily fluctuations of temperature between 15-20°C decreased the rate of hatching by 12%, although the upper limit of temperature during the first day of incubation was exceeded only for 5 hours. The influence of light on the rate of hatching was shown by experiments at constant temperatures between 15 and 24°C. There were no indications that light influences the hatching rate or temperature tolerance in pike eggs. Larvae from eggs exposed to temperatures above 18°C at a very early embryonic stage demonstrated a decrease in vitality. Decrease of larval vitality did not occur when eggs were exposed to 18°C after being 24 day-degrees at lower temperatures (12°C), to 21°C after 36 day-degrees, and to 24°C after reaching an egg stage equal to 60 day-degrees (at 12°C). Larvae from eggs hatched at 5.8°C developed normally when they were brought to higher temperatures soon after hatching. If they stayed at 5.8°C after hatching, most of them died the next day; surviving larvae did not swim up. Based on our experimental results, the survival rates of pike eggs and larvae under natural conditions are discussed. (Auth.)

11273. Halsband, E. and I. (Institut für Küsten-und Binnenfischerei der Bundesforschungsanstalt für Fischerei, Hamburg, West Germany). 1967. THE CONDUCTIVITY OF THE FISH BODY ACCORDING TO THE INFLUENCE OF DIFFERENT EXTERNAL FACTORS. (Die Leitfähigkeit des Fischkörpers nach Einwirkung verschiedener Aussenfaktoren). Archiv für Fischereiwissenschaft, 17(2): 134-140.

The resistance of trout (Salmo gairdneri), which were subjected to various salt solutions, was measured. It was shown that the composition of the external medium influences the conductivity or resistance of the fish, and therewith its intake of current. Hydration-promoting substances lead to a raising of resistance and lowering of the current-intake capacity, whereas hydration-inhibiting substances lower the resistance of the fish body and increase its current intake. (Authors)

11274. Reichenbach-Klinke, H. H. (Bayerischen Biologischen Versuchsanstalt München (Demoll-Hofer-Institut, West Germany). 1967. INVESTIGATIONS ON THE INFLUENCE OF THE AMMONIA CONTENT ON THE FISH ORGANISM. (Untersuchungen über die Einwirkung des Ammoniakgehalts auf den Fischorganismus). Archiv für Fischereiwissenschaft, 17(2): 122-132.

The effect of various amounts of ammonia on tissue was examined in 240 fishes. The following significant damage occurred to the tissue: diminishing of the number of blood-cells; swelling of the cells; gills becoming lumpy; inflammations and hyperplasia. Newly hatched animals are most sensitive. Therefore, it can be assumed that in water with definite ammonia content, the number of fry is reduced. Various wastewater poisons (phenol, inorganic salts) increase the effect of ammonia, so that the times for manifestation are lower. Special attention is called to the fact that tissues poor in oxygen are infiltrated more easily than those rich in oxygen. Considering pH, irreversible blood damage occurs in trout fry at NH_3 concentration of only 0.27 mg per liter of water. The development of the damage is characterized by the following phases: reduction of the number of erythrocytes; inflammatory and regulative processes with renewed increase of the number of red blood cells; swelling of cells; hyperplasia; symptoms of degeneration; irreversible lowering of the number of red blood cells (Auth.)

11275. Bureau of Sport Fisheries and Wildlife. 1968. LABORATORIES FOR FISH DISEASE RESEARCH. United States Department of the Interior, Bureau of Sport Fisheries and Wildlife, Resource Publication 73.

11276. Holm, L. G., L. W. Weldon, and R. D. Blackburn. (College of Agriculture of the Univ. of Wisconsin, Madison). 1969. AQUATIC WEEDS. Science 166(3906): 699-709.

11277. Messersmith, James (Calif. Dept. of Fish and Game, Marine Resources Operations). 1966. FISHES COLLECTED IN CARQUINEZ STRAIT IN 1961-1962. Fish Bull. 133, Calif. Dept. of Fish and Game, Ecological Studies of the Sacramento-San Joaquin Estuary, Part I, Zooplankton, Zoobenthos, and Fishes of San Pablo and Suisun Bays, Zooplankton and Zoobenthos of the Delta, 57-63.

The northern anchovy, Engraulis mordax, was by far the most abundant species taken. Of the more than 750,000 fish caught, 63 percent were anchovies. Anchovies were most densely concentrated in Carquinez Strait from June through August. The Pacific herring, Clupea pallasi, was the second most abundant species, comprising 27 percent of the total. Practically all the herring were caught between March and July. Over 9 percent of the total catch consisted of Sacramento smelt, Spirinchus thaleichthys, jacksmelt, Atherinopsis californiensis, striped bass, Roccus saxatilis and American shad, Alosa sapidissima, in that order. The remaining 42 species of fish made up less than 1 percent of the total catch. (Auth.)

11278. Ganssle, David. 1966. FISHES AND DECAPODS OF SAN PABLO AND SUISUN BAYS. Fish Bull. 133, Calif. Dept. of Fish and Game, Ecological Studies of the Sacramento-San Joaquin Estuary, Part I, Zooplankton, Zoobenthos, and Fishes of San Pablo and Suisun Bays, Zooplankton and Zoobenthos of the Delta, 64-94.

11279. McCraren, Joseph P., Oliver B. Cope, and Lafayette Eller. 1969. SOME CHRONIC EFFECTS OF DIURON ON BLUEGILLS. Weed Science, 17(4): 497-504.

Effects of sub-acute levels of 3-(3,4-dichlorophenyl)-1, 1-dimethylurea (diuron) on bluegill sunfish (Lepomis machrochirus, Rafinesque) were assessed in a pond environment. Eight 0.1-A earthern ponds were each stocked with 300 bluegill fingerlings and treated once with diuron wettable powder at 0, 0.5, 1.5, and 3.0 ppmw, two ponds per treatment level. Dissolved oxygen was reduced severely in some pond waters 2 days following treatment and the low level persisted for 3 to 4 days. Gill lamellae were ruptured and hemorrhagic in 20% of the fish from the 3.0 ppmw ponds at 3 days post-treatment. Fish in a cage succumbed

during this period in a 3.0 ppmw pond. No further bluegill mortality was observed in treated ponds 3 days after treatment. Hematocrit measurements of treated and control fish could not be correlated with treatment level. Best growth was exhibited by control fish and their progeny. Diuron residues were not detectable in treated pond waters after 28 days. Residues of diuron in treated-pond vegetation were detectable up to 95 days following treatment, whereas residues in mud were measured by gas chromatography 122 days after treatment. Invertebrate populations increased in all ponds with time, indicating little or no effect of the herbicide on their numbers. Good control of filamentous algae and vascular aquatic vegetation was demonstrated in the treated ponds. (Authors)

11280. Maetz, J. 1969. SEAWATER TELEOSTS: EVIDENCE FOR A SODIUM-POTASSIUM EXCHANGE IN THE BRANCHIAL SODIUM-EXCRETING PUMP. Science, 166(3905): 613-615.

The net sodium extrusion rate by the gill of the seawater-adapted euryhaline flounder is identical to the potassium influx. The excretion of sodium is blocked in K+-free seawater solutions. The instantaneous sodium outflux readjustment pattern of flounders transferred from seawater to solutions of various sodium chloride or potassium chloride concentrations is consistent with the hypothesis of a linkage between Na+ and K+ influx through a common exchange carrier. External Na+ and K+ compete for this common carrier. It is suggested that the exchange diffusion mechanism (linkage of sodium influx and outflux) and the high internal sodium turnover rate which characterizes all seawater teleosts are the results of this competitive process. The sodium-potassium dependent adenosine triphosphatase system occurring in the gill of the seawater teleosts may play a central role in this sodium-potassium exchange pump. (Auth.)

11281. Bureau of Sport Fisheries and Wildlife. 1968. THE SALMON CULTURAL LABORATORY. United States Department of the Interior, Bureau of Sport Fisheries and Wildlife, RP-52.

11282. Stern, D. H., and B. H. Atwell (Dept. of Biology, Univ. of Missouri - Kansas City, Kansas City, Missouri). 1968. A SUMMER LIMNOLOGICAL STUDY OF LAKE PONTCHARTRAIN, LOUISIANA. Tech. Rept. No. 3, La. Water Resources Research Inst., La. State Univ., Baton Rouge, Louisiana. 83 p.

Basic physical, chemical, and biological data were collected in the summer of 1968 in preparation for future investigations of Lake Pontchartrain, Louisiana. Biweekly samples were collected at 26 stations during June and July. Field measurements at each station included the following physical and chemical factors: dissolved oxygen, pH, relative light transmission, salinity, Secchi disc visibility, specific conductance, and alkalinity. Laboratory analyses of the lake water included the following factors: aluminum, barium, coliform bacteria, copper, cyanide, detergents, nitrate-nitrogen, orthophosphate, silica, sodium and chloride ions, sulfate, tannins and lignins, total hardness, total iron, total nitrogen, and turbidity. Plankton tows were made during most station visits, and bottom sediments were collected from most stations in June. The plankton composition and abundance was studied, and the pH and organic matter content of the bottom sediments were examined. (Authors)

11283. Ballard, J. A., and W. D. Oliff (National Inst. for Water Research, Council for Scientific & Industrial Research, Natal Regional Lab., Congella, Natal, South Africa). 1969. A RAPID METHOD FOR MEASURING THE ACUTE TOXICITY OF DISSOLVED MATERIALS TO MARINE FISHES. Water Research, 3(5): 313-333.

A rapid residual oxygen method for measuring the acute toxicity of dissolved poisons to fish is described and evaluated in comparison with the routine 24 or 48 hour test. The effects of varying the densities per unit volume of test fishes, the temperature, and the size of the fish are examined. It is concluded that the residual oxygen method is a quick and reliable method for routine monitoring work. (Authors)

11284. Stern, D. H., and M. S. Stern (Dept. of Biology, Univ. Missouri - Kansas City, Kansas City, Missouri). 1969. PHYSICAL, CHEMICAL, BACTERIAL, AND PLANKTON DYNAMICS OF LAKE PONTCHARTRAIN, LOUISIANA. Tech. Report No. 4, La. Water Resources Research Inst., Louisiana State Univ., Baton Rouge, Louisiana, 60 p.

Preliminary and intensive studies from November 1968 to July 1969 showed that the discharge of storm water into Lake Pontchartrain, Louisiana, affects the water quality and population dynamics of aquatic microorganisms. Especially after heavy rains in Orleans Parish, the presence of coliforms renders the near-shore water and beaches unsafe for some water sports. Storm drainage from Jefferson Parish also supplies coliforms that are transported to the New Orleans shore-line. Phosphates, nitrates, and nitrites nourish and bring about increases in phytoplankton and bacteria. Lake sediments, stirred up by wind waves and during heavy rains, increase the turbidity; the reduced light available for photosynthesis results in the death of phytoplankton, which add to the bottom organic materials and subsequently furnish food for more plankton growth, thus hastening the filling of the lake. The use of total instead of fecal coliform counts does not give the true degree of pollution because no consistent relationship was found between the two. Recommendations include: counting of fecal coliforms to determine water quality; prohibition or discouragement of swimming, skiing, and other primary water sports at certain beaches after summer rains; careful regulation of proposed chlorination of storm water owing to presence of ammonia, which retards the disinfection process, and because of unreacted chlorine, which will disrupt the natural food web; and basin-wide cooperation to prevent or reduce further pollution. (Authors)

11285. Lloyd, R., and Lydia D. Orr (Salmon & Freshwater Fisheries Lab., M. A. F. F., London, England). 1969. THE DIURETIC RESPONSE BY RAINBOW TROUT TO SUB-LETHAL CONCENTRATIONS OF AMMONIA. Water Research, 3(5): 335-344.

The rate of urine excretion by rainbow trout increases with a rise in the concentration of ambient un-ionized ammonia. It is suggested that this diuresis is caused by an increase in the permeability of the fish to water. Quantitative measurements of urine excretion rates indicate that concentrations of un-ionized ammonia below 12 percent of the lethal threshold concentration may be without toxic effect. Increases in temperature produce no well defined trend in urine excretion rates with a given concentration of un-ionized ammonia, but normal excretion rates have a Q_{10} of 2-4. Some evidence is presented for acclimation of rainbow trout to sub-lethal levels of ammonia. It is suggested that any environmental factor which affects the water balance of fish may also influence their susceptibility to ammonia poisoning. (Authors)

11286. Swank, W. T., and N. H. Miner (Forest Service, U. S. Dept. of Agriculture, Asheville, North Carolina). 1968. CONVERSION OF HARDWOOD-COVERED WATERSHEDS TO WHITE PINE REDUCES WATER YIELD. Water Resources Research, 4(5): 947-954.

Mixed mature hardwoods were cleared from two Southern Appalachian experimental watersheds, and the areas were planted with eastern white pine in 1956-1957. Once the pine crowns began to close, streamflow steadily declined at a rate of 1 to 2 inches per year. By 1967, water yield was 3.7 inches less from a 10-year-old pine stand on a south-facing watershed than expected water yield from the original hardwood forest. Most of the water yield reduction occurred during the dormant season and was attributed mainly to greater interception loss from white pine than from hardwoods. Because interception differences increase as white pine matures, an even greater reduction in streamflow is expected. (Authors)

11287. Bureau of Sport Fisheries and Wildlife. 1969. THE WESTERN FISH NUTRITION LABORATORY. United States Department of the Interior, Bureau of Sport Fisheries and Wildlife, RP-81.

11288. Brown, George W. (Forest Research Lab., School of Forestry, Oregon State Univ., Corvallis, Oregon). 1969. PREDICTING TEMPERATURES OF SMALL STREAMS. Water Resources Research, 5(1): 68-75.

Hourly temperatures of small streams can be accurately predicted using an energy balance. Micrometeorological measurements are required to assess the environment of the small stream accurately. The temperature-prediction technique was tested on three streams in Oregon. On unshaded stretches, net all-wave radiation is the predominant energy source during the day; evaporation and convection account for less that 10% of the total energy exchange. Conduction of heat into the stream bottom is an important energy balance component on shallow streams having a bedrock bottom. Up to 25% of the energy absorbed by such a stream may be transferred into the bed. Hourly temperature changes of 0-16°F were predicted to within 1°F more than 90% of the time. This technique permits foresters to control water temperature through manipulation of stream-side vegetation. (Auth.)

11289. Grigor'eva, M. B. 1967. THE INFLUENCE OF THE SHOALING HABIT ON GAS EXCHANGE IN FISH. (Vliyanie stainosti na gazoobmen ryb). Povedenie i Retseptsii Ryb, Akademiya Nauk SSSR, Ministerstvo Rybnogo Khozyaistva SSSR, Ikhtiologicheskaya Komissiya, "NAUKA", Moscow, 37-41. (Translation): Robert M. Howland, Division of Fishery Research, Bureau of Sport Fisheries and Wildlife, Washington, D. C.

Along with other adaptations in aquatic animals, the ability to change the intensity of oxygen consumption in a school has been developed. The shoaling effect was studied on the Kuban vimba and the shemaya, in the larval and fry stages; embryos and larvae of the roach also were utilized, as well as chironomid larvae and amphipods. Vimba or shemaya fry in a group of 2-3 respire approximately 2 times more intensively than in a group of 10. The well expressed shoaling effect in embryos, and also in 1.5-day roach larvae, which lie motionless on the bottom for the most part, shows that it is impossible to attribute this effect only to the degree of mobility of the organisms. The shoaling effect must be regarded as an adaptational reaction, activated apparently by visual perceptions and the accumulation of metabolic products. In order to obtain comparable results in conducting experiments on gas exchange in aquatic organisms, it is necessary to account for the influence of the shoaling effect. -- Robert M. Howland

11290. Bogdanov, A. S., S. I. Doroshev, and A. F. Karpevich. 1967. EXPERIMENTAL TRANSFER OF Salmo gairdneri Richardson AND Roccus saxatilis (Walb.) FROM THE USA FOR ACCLIMATIZATION IN WATERS OF THE USSR. (Opytnaya perevozka Salmo gairdneri Richardson; Roccus saxatilis (Walb.) iz SSHA dlya aklimatizatsii v vodoemakh SSSR). Voprosy Ikhtiologii, Akademiya Nauk SSSR, Moscow, 7(1): 185-187. (Translation): Robert M. Howland, Division of Fishery Research, Bureau of Sport Fisheries and Wildlife, Washington, D. C.

Acclimatizational work has received much attention in the USSR in recent years. One hundred thousand steelhead trout eggs were shipped by air from the USA to a Soviet fish hatchery in 1965; mortality due to shipment was less than 2%. Various rations were used in rearing the young steelheads. At the end of summer--start of autumn the young steelhead trout were released into the rivers of the Azov and Black Seas: 30 thousand into the Chernaya and Psou Rivers, and 14 thousand into the Kuban. Others were kept under observation at the Chernorechenskoe Hatchery. Fifty thousand two-day-old striped bass larvae were air-shipped in April of 1965. En route between Washington and Moscow, the larvae went 55 hours without a change of water and a supplementary charge of oxygen; mortality was about 72%. Of the 14 thousand live larvae obtained in the first shipment, 1,000 fry were reared successfully; mortality was heaviest during the first days after transport. A second shipment of fifty thousand was received in May. Due to oxygen leakage from the polyethylene packets, many larvae died en route. Of the 3,000 larvae remaining alive, 200 fry were grown successfully to a size of 15-35 mm. They were set out in the mouth of the Khipsta River on the Black Sea shore of the Caucasus. -- Robert M. Howland

11291. Pomiluiko, V. P. 1968. CHARACTERISTICS OF NITROGEN AND PHOSPHORUS NUTRITION OF Aphanizomenon flos-aquae UNDER NATURAL CONDITIONS. (Osobennosti azotnogo i fosfornogo pitaniya Aphanizomenon flos-aquae v estestvennykh usloviyakh). Gid. Zhurnal, 4(4): 18-22. (Translation): Robert M. Howland, Division of Fishery Research, Bureau of Sport Fisheries and Wildlife, Washington, D. C.

The daily dynamics of nitrogen and phosphorus absorption from a body of water by the blue-green alga Aphanizomenon flos-aquae during the vegetative period was studied. At the same time the dry weight of the algae, the quantity of oxygen and the pH of the environment were considered. It was established that this alga is more demanding of nitrogen than of phosphorus. It develops well in the absence of ammonium nitrogen. (Auth.)

11292. Ponomarenko, V. P. 1967. FEEDING OF THE LARVAE AND FRY OF THE ARCTIC COD (Boreogadus saida Lepechin) IN THE BARENTS AND KARA SEAS. (Pitanie lichinok i mal'kov saiki (Boreogadus saida Lepechin) v Barentsevom i Karskom moryakh). Materialy Rybokhozyaistvennykh Issledovanii Severnogo Basseina, Vypusk X, Ministerstvo Rybnogo Khozyaistva SSSR, Polyarnyi Nauchno-Issledovatel'skii i Proektnyi Institut Morskogo Rybnogo Khozyaistva i Okeanografii Im. N. M. Knipovicha (PINRO), Murmansk 10: 20-27. (Translation): Robert M. Howland, Division of Fishery Research, Bureau of Sport Fisheries and Wildlife, Washington, D. C.

The life of Arctic cod larvae and fry is primarily connected with the life cycle of Oithona similis, and also with the characteristics of the biological seasons in Arctic seas. According to the degree of growth of Arctic cod larvae and fry, food organisms are replaced in the following sequence: eggs, nauplii and the copepodites of Copepoda. The larvae of Arctic cod, hatching from spawn at the edge of the ice, appear amid conditions of maximal concentration of copepod eggs. Copepod nauplii and copepodites are most abundant in open water. At this time and at these places the Arctic cod larvae appear. Evidently, this is one of the factors which has ensured the great abundance of the Arctic cod as a species. (Auth.)

11293. Altukhov, Yu. P., V. S. Apekin, and V. V. Limanskii. 1964. BASIC PRINCIPLES FOR THE INVESTIGATION OF INTRA- AND INTERSPECIFIC DIFFERENTIATION IN FISH BY SEROLOGICAL METHODS. (Osnovnye printsipy issledovaniya vnutri- i mezhvidovoi differentsirovki u ryb serologicheskimi metodami). Trudy Azovo-Chernomorskogo Nauchno-Issledovatel'skogo Instituta Morskogo Rybnogo Khozyaistva i Okeanografii, 22: 53-71. (Translation): Robert M. Howland, Division of Fishery Research, Bureau of Sport Fisheries and Wildlife, Washington, D. C.

Serological reactions are utilized for the study of the immunity effect; that is, in the narrow sense, the non-susceptibility of the organism to different kinds of infectious diseases. This non-susceptibility is connected with the ability of the animal organism to withstand parenteral penetration by any microbic or other agent of a protein nature - the antigen. The mechanism of such resistance is varied, but in most cases it comes down to neutralization of the antigen with special protein bodies (antibodies), which are produced in the immunized animal and act in the blood stream. The antibodies are divided into groups according to the character of their interaction with the antigen, the most important of these being the precipitins and agglutinins. The antigen-antibody reaction is extremely specific; however, this specificity is not absolute and the antibodies generated against a specific antigen are also capable of combining with other antigens, with intensity corresponding to their physico-chemical compatibility. This compatibility in turn determines the degree of phylogenetic nearness of the analyzed organisms (the principle of quantitative serological specificity). The methodology of the reactions of precipitation and agglutination in fish is presented in detail. Effort has been made to furnish sufficient information in one volume for the organization and conducting of serological experiments by an ichthyological investigator without immunological training. -- Robert M. Howland

11294. Korzhuev, P. A., and T. N. Glazova. 1968. COMPARATIVE PHYSIOLOGICAL CHARACTERISTICS OF THE BLOOD AND HEMATOPOIETIC ORGANS OF FISH AND AQUATIC MAMMALS. (Sravnitel'no - fiziologicheskaya Kharakteristika Krovi i krovotvornykh organov ryb i vodnykh mlekopitayushchikh). Fiziologicheskie Osnovy Ekologii Vodnykh Zhivotnykh, Seriya Biologiya Morya Vyp. 15. Institut Biologii Yuzhnykh Morei Im. A. O. Kovalevskogo, Akademiya Nauk Ukrainskoi SSR, "Naukova Dumka", Kiev, 131-146. (Translation): Robert M. Howland, Division of Fishery Research, Bureau of Sport Fisheries and Wildlife, Washington, D. C.

Perhaps the most significant factor of the aquatic environment is sharp reduction of the effect of the force of gravity. Aquatic organisms spend practically no energy for supporting their bodies in contrast to terrestrial animals. This factor must be considered when comparing the blood peculiarities of fish and secondarily-aquatic mammals. The quantitative-qualitative blood characteristic of different fish groups is defined not only phylogenetically, but also ecologically. One can get an idea of the biological significance of blood pecularities by simultaneous consideration of the amount of blood, the concentration of its respiratory pigments and the magnitude of the erythropoietic centers. The centers of erythropoiesis are much more developed in aquatic mammals in contrast to fish. In addition, the musculature of aquatic mammals contains large stores of highly concentrated myoglobin, which holds oxygen. The unequal affinity for oxygen of the hemoglobin of different species of fish and aquatic mammals is the result of varied adaptation to the specific conditions of the aquatic environment. The heterogeneous nature of hemoglobins is closely associated with the degree of oxygen affinity of the hemoglobin. (Auth. summ. -- edited by Robert M. Howland)

11295. Lyakhov, S. M., and L. N. Krylova. 1968. ON THE RESULTS OF TRANSPLANTING MYSIDS FROM THE DON TO KUTULUKSKOE RESERVOIR. (O rezul'tatakh peresadki mizid iz dona v Kutulukskoe vodokhranilishche). Gid Zhurnal, 4(4): 39-40. (Translation): Robert M. Howland, Division of Sport Fisheries and Wildlife, Washington, D. C.

Kutulukskoe Reservoir was created in 1939 in the valley of the small river Kutuluk, which enters into the basin of the river Samara -- a left-shore tributary of the Volga. Commercial fishing for bream, pikeperch and carp is conducted. In order to increase the food supply, several species of mysids were transplanted from the Don River in 1962, and again in 1964. One of these species, Mesomysis kowalevskyi, adapted to conditions in Kutulukskoe Reservoir and proliferated, as shown by sampling. -- Robert M. Howland

11296. Khung, Nguen Kim. 1968. THE CONTENT OF FREE AMINO ACIDS IN THE MUSCLES OF THE BLACK SEA GREY MULLET IN RELATION TO WATER SALINITY. (Soderzhanie svobodnykh aminok islot v myshtsakh Chernomorskoi kefali v zavisimosti ot solenosti vody). Rybnoe Khozyaistvo, 9, September, Moscow, p. 7 (Translation): Robert M. Howland, Division of Fishery Research, Bureau of Sport Fisheries and Wildlife, Washington, D. C.

At the Odessa Branch of the Institute of Biology of Southern Seas AN USSR an experiment was carried out to determine how the free amino acids in muscles of the Black Sea grey mullet change upon migration from the sea into an estuary where the water decreases considerably in salinity or is completely fresh. A total of 18 free amino acids was revealed: cystine, cysteine, lysine, histidine, arginine, aspartic acid, serine, glycine, glutamic acid, threonine, α-alanine, proline, tyrosine, α-aminobutyric acid, methionine, valine, phenylanine and leucine. It was shown that the content of amino acids in tissues of the grey mullet decreases markedly with drop in water salinity. It is obvious that besides water salinity other factors also exert influence on their content. - Robert M. Howland

11297. Rohr, Bennie A. 1968. SURFACE SCHOOLING OF RED DRUM. Underwater Naturalist, Bulletin of the American Littoral Society, 5(2): 21-23.

11298. Kamshilov, M. M. 1967. SELECTION FOR INCREASED RESISTANCE TO ULTRAVIOLET RAYS IN DIFFERENT LINES OF FLAGELLATES. (Otbor na povyshennuyu ustoichivost' k ultrafioletovym lucham v razlichnykh liniyakh zhgutikonostsev). Luchistye Faktory Zhizni Vodnykh Organizmov. Akademiya Nauk SSSR, Institut Biologii Vnutrennikh Vod, "NAUKA", Leningrad, 14(17): 54-83. (Translation): Robert M. Howland, Division of Fishery Research, Bureau of Sport Fisheries and Wildlife, Washington, D. C.

Data are presented in the report on the effect of large doses of UV irradiation at a spectral line of 253.7 mμ on different strains of colorless flagellates. The effectiveness of selection for increased resistance to UV rays with the help of high doses of UV irradiation was revealed. As a result of such selection a number of lines arose which differed from the originals by a high growth rate and the ability to reach an increased abundance even without exposure. Selection for resistance to the destructive influence of UV photons therefore proceeded basically through the survival of individuals which differed by increased stability of the synthetic processes of the cell in regard to different influences. A sharp stimulating effect of the influence of UV exposure on the flagellates was revealed. It was shown that stimulation of activity arises as a result of the direct absorption of UV photons by the protoplasm of the flagellates. UV rays seem to charge the cells of Bodo, intensifying their activity. The stimulating effect is maintained for several generations and then is lost. A hypothesis about two receptors of UV rays in the cell is discussed. (Auth.)

11299. Vinberg, G. C. 1968. INTERDEPENDENCE BETWEEN INTENSITY OF METABOLISM AND RATE OF GROWTH IN ANIMALS. (Vzaimozavisimost' intensivnosti obmena i skorosti rosta u zhivotnykh). Fiziologicheskie Osnovy Ekologii Vodnykh Zhivotnykh. Seriya Biologiya Morya Vyp. 15. Institut Biologii Yuzhnykh Morei Im. A. O. Kovalevskogo, Akademiya Nauk Ukrainskoi SSR. "Naukova Dumka", Kiev, 5-15. (Translation): Robert M. Howland, Division of Fishery Research, Bureau of Sport Fisheries and Wildlife, Washington, D. C.

The physiologically specified relationship between rate of growth and intensity of metabolism is of great interest to hydrobiologists. Growth, or reproduction, is equal to that portion of the assimilated food which has not been spent in the process of metabolism, for the time under consideration:

$$\frac{P}{(P + T)} = K'',$$

where (P + T) is the assimilated food, equaling the sum of growth (P) and the expenditure for metabolism (T), and K'' is a dimensionless constant expressing the efficiency of utilization of assimilated food for growth. Modifications and elaborations of this basic formula are presented. -- Robert M. Howland

11300. Kulikova, N. I. 1968. CHARACTERISTICS OF THE BLOOD PROTEIN COMPOSITION OF HORSE MACKERELS OF SOUTHERN SEAS. (Osobennosti belkovogo sostava Krovi stavrid yuzhnykh morei). Fiziologicheskie Osnovy Ekologii Vodnykh Zhivotnykh. Seriya Biologiya Morya Vyp. 15. Institut Biologii Yuzhnykh Morei Im. A. O. Kovalevskogo, Akademiya Nauk Ukrainskoi SSR, "Naukova Dumka", Kiev, 147-158. (Translation): Robert M. Howland, Division of Fishery Research, Bureau of Sport Fisheries and Wildlife, Washington, D. C.

A method of electrophoresis on paper was employed for clarification of the specificity of protein composition in the blood serum of close species of horse mackerels of southern seas. The characteristics of protein composition in the blood of the fish in relation to their living conditions also were traced. The family Carangidae can be characterized in the following way: A. The horse mackerels are characterized by the presence of a clearly delimited fraction of albumin, the relative content of which ranges from 15 to 38% in the different species. B. All basic protein components are present in the majority of species: albumin, α-, β- and γ-globulins. Trachurus trecae and Decapturus punctatus are the exceptions, since no γ-globulin was found in them. C. In all species α-globulin is the predominant protein fraction; therefore, α/β is always greater

than unity. The albumin-globulin coefficient is less than 0.5 in almost all of the horse mackerels. Individual variations in the quantity and ratio of protein fractions in horse mackerels are significant only during the pre-spawning and spawning periods. Sexual differences are expressed only during the spawning period. The blood protein composition of each studied species and subspecies of horse mackerel of the genera Trachurus and Decapturus is specific. Differences between subspecies within a species are developed less distinctly than interspecific differences. Within the genus Trachurus, according to blood protein composition, the Black Sea, Mediterranean Sea and Red Sea forms of horse mackerel differ more from the Atlantic forms, than among themselves. Tr. trecae is removed considerably from Tr. trachurus, as well as from the horse mackerels listed above. The general features of protein composition of the blood serum which distinguish the family under consideration from the other families in the suborder Percoidei (according to the data in the literature), are peculiar to all of the species of horse mackerels of the family Carangidae. The data obtained on six close species of horse mackerels of the genera Trachurus and Decapturus, five close species of Azov gobies of the genus Gobius, and the data in the literature, confirm our hypothesis stated previously on belonging of the large and small forms of the Black Sea horse mackerel to a single species --- Trachurus mediterraneus. -- Robert M. Howland

11301. Danyulite, G. P. and G. A. Malyukina. 1967. INVESTIGATION OF THE PHYSIOLOGICAL MECHANISM OF ACTION OF A DIRECT-CURRENT ELECTRICAL FIELD ON FISH. (Issledovanie fiziologicheskogo mekhanizma deistviya polya postoyannogo elektroforicheskogo toka na ryb). Povedenie i Retseptsii Ryb, Akademiya Nauk SSSR, Ministerstvo Rybnogo Khozyaistva SSR, Ikhtiologicheskaya Komissiya. "NAUKA", Moscow, 56-62. (Translation): Robert M. Howland, Division of Fishery Research, Bureau of Sport Fisheries and Wildlife, Washington, D. C.

Many investigators have observed and studied the behavior of fish in an electrical field; however, up to now there has been no clear presentation about what systems of the organism determine the reaction of fish to a current and what the mechanism is of regular behavior of a fish in a field of current. The data obtained from this study allow certain conclusions and hypotheses to be made. The skin receptors do not take part in the perception of a field of electrical current by fish. Removal of sections of the brain did not affect accomplishment of the anodic reaction. In fish with the spinal cord severed at the second vertebra, as well as in intact fish, manifestation of the reaction depended on the direction of the current. It can be hypothesized that the leading role in origination of the anodic reaction belongs to the spinal cord. After destruction of the spinal cord, the action of a direct current does not cause the anodic reaction in fish; only with positioning of the fish across the lines of current is anodic bending observed. One can hypothesize that anodic bending is brought about as a result of the direct excitation of the motor fibers of the spinal nerves. Anodic bending as well as the anodic reaction disappear after blockage of myoneural transmission. Thus, neither excitation of the myoneural synapses (which remained intact in the experiments involving destruction of the spinal cord), nor excitation of the very muscles guarantees a directed movement of the fish to the anode in a direct-current field, as was supposed by a number of investigators. The derived data and conclusions were corroborated by the results of rapid motion-picture filming of the motor reaction of intact and spinal fish in a field of direct current. -- Robert M. Howland

11302. Scott, W. B., and E. J. Crossman. 1969. CHECKLIST OF CANADIAN FRESHWATER FISHES WITH KEYS FOR IDENTIFICATION. Royal Ontario Museum, Life Sciences, miscellaneous publications, September 1969.

11303. Clark, John, W. G. Smith, Arthur W. Kendall, Jr., and Michael P. Fahay (Sandy Hook Marine Laboratory, Highlands, New Jersey). 1969. STUDIES OF ESTUARINE DEPENDENCE OF ATLANTIC COASTAL FISHES. Technical Papers of the Bureau of Sport Fisheries and Wildlife, United States Department of the Interior, August 1969.

Data Report I: Northern Section, Cape Cod to Cape Lookout. R. V. Dolphin Cruises 1965-66: Zooplankton volumes, midwater trawl collections, temperatures and salinities.

11304. Lebedev, Yu. M., and T. S. Mal'tsman. 1967. THE PRIMARY PRODUCTION OF PLANKTON AND ITS UTILIZATION IN DOMASHKINSKOE IRRIGATION RESERVOIR OF THE ORENBURG REGION. (Pervichnaya produktsiya planktona i ee ispol'zovanie v domashkinskom orositel'nom vodokhranilishche Orenburgskoi oblasti). Mikroflora, Fitoplankton i Vysshaya Rastitel'nost' Vnutrennikh Vodoemov, Akademiya Nauk SSSR, Institut Biologii Vnutennikh Vod, "NAUKA", Leningrad, 15(18): 154-174. (Translation): Robert M. Howland, Division of Fishery Research, Bureau of Sport Fisheries and Wildlife, Washington, D. C.

The primary production of plankton is Domashkinskoe Reservoir (area 5.53 km^2, average depth 3^+m) in 1962 from the middle of July through the middle of September comprised 613.7 large calories/m^2, or 6.5 large calories/m^2·day. Primary production for the entire vegetative period is estimated at 1200 large calories/m^2, and with calculation of the production of macrophytes, up to 1500 large calories/m^2. Total production of crustacean zooplankton comprised 1.93 tons of wet matter per hectare of reservoir area. The calculated ratios of rations to production of the preceding link in the chain, phytoplankton --- non-predatory zooplankton --- predatory zooplankton, equaled 0.5. At increase in the population of each trophic level, half of the food consumed was utilized, i.e. the production of the succeeding trophic level is 4 times less than the production of the preceding level. If one spreads such a relationship to the utilization of energy in but one link --- the plankton eating fishes, then the energy of terminal production amounts to 1% of the energy of the gross production of phytoplankton (122-132 kg/hectare). In calculation of the production of fish-planktophages through possible eating of the zooplankton, this quantity comprised 124 kg/hectare. Thus, both methods of calculation give corresponding figures. (Authors summ.)

11305. Askerov, T. A. 1968. A METHOD FOR CONTROL OF SAPROLEGNIAL FUNGUS. (Metod bor'by s saprolegnievym gribkom). Rybnoe Khozyaistvo, October 10, Moscow, 23-24. (Translation): Robert M. Howland, Division of Fishery Research, Washington, D. C.

In the spring of 1967 at the Kurinskoe Experimental Sturgeon Station malachite green in a 1:100,000 solution was utilized for combating saprolegnia, which had infected wild carp spawn in Yushchenko, Sadova-Kokhanskoi, Veisa and Ses-Grina apparatuses. The success of spawn incubation was increased by 18 - 25% through the use of malachite green in these apparatuses. Operation of the Sadova-Kokhanskoi apparatus, involving use of the ultraviolet bactericidal device, is rather complex; it is more expedient to apply malachite green to control saprolegnia. Efficacy trials in Petri dishes showed that a malachite green solution of 1:100,000 has a destructive effect on saprolegnia, and is harmless to wild carp spawn. -- Robert M. Howland

11306. Zusser, S. G. 1967. CONCERNING STUDY OF THE REASONS FOR THE ATTRACTION OF FISH TO LIGHT. (Ob izuchenii prichin privlecheniya ryb na svet). Povedenie i Retseptsii Ryb, Akademiya Nauk SSSR, Ministerstvo Rybnogo Khozyaistva SSSR, Ikhtiologicheskaya Komissiya, "NAUKA", Moscow, 95-99. (Translation): Robert M. Howland, Division of Fishery Research, Bureau of Sport Fisheries and Wildlife, Washington, D. C.

The influence of light on the activity of fish is extremely varied; it is perceived differently by fish, depending on the ecological peculiarities of the species and the functional condition of the organism. Analysis of the reasons for the attraction of plankton-feeding fishes to an underwater source of light led to the hypothesis that this phenomenon is basically analogous with the diurnal vertical migrations of these fishes. The reaction of larval fish to light is closely connected with their way of life; embryos of the bitterling, bream, glazacha, vimba and gudgeon, which react negatively to light in the first days after hatching, and also embryos of the roach and crucian carp, which are indifferent to light, upon shifting to the larval stage begin to be directed to it positively, seeking food visually. In larval sturgeon fed in the dark, the reaction to light remained negative, but in the group fed in the light, it remained positive. Therefore, with

changeover of the larvae to active feeding, light took on nutritive signaling significance. Reaction to the appearance of illumination in marine waters bears a reflex signaling character; it changes in relation to the physiological conditions of the organism (degree of nourishment, fatness, oiliness, stages of ripeness of sexual products, water temperature, etc.). The reasons for the attraction of fish to light and for behavior in an illuminated zone are not well defined sides of the phenomenon, and their investigation must be conducted by different methods. -- Robert M. Howland

11307. Piskunov, I. A., and A. M. Kharchenko. 1968. COMMERCIAL INVESTIGATIONS OF TUNA IN THE INDIAN OCEAN. (Promyslovye issledovaniya tuntsov v Indiiskom Okeane). Trudy Vsesoyuznogo Nauchno-Issledovatel'skogo Instituta Morskogo Rybnogo Khozyaistva i Okeanografii (VINRO), 64: 344-373. (Translation): Robert M. Howland, Division of Fishery Research, Bureau of Sport Fisheries and Wildlife, Washington, D. C.

Domestic fishery organizations recently have begun to pay more attention to the development of a tuna fishery. Exploratory longlining voyages were made in 1964 into the Indian Ocean. Fishing was conducted in the waters adjacent to the Seychelles Islands, Saya-de-Malha Bank and Chagos Archipelago. For 131 working days the tuna-fishing base ship "Leninskii Luch" caught 8,074 centners of all species of fish, of which tunas comprised 58 percent, marlins - 9 percent, swordfish - 3 percent, sailfish - 2 percent, and sharks - 28 percent. Of 17,097 specimens, 82 percent were tunas and swordfishes and 18 percent - sharks. The largest catches were made in those fishing zones where the thermocline was situated between 50 - 70 m; the catches dropped when the thermocline was higher than 50 m and lower than 70 m. The best living conditions for tuna are found in the zone of the upper limit of the thermocline. When setting the longline, effort must be made to locate the hooks above the layer of discontinuity. The body length of the yellowfin tuna ranged from 47 to 192 cm. Fish with a length of 116 to 150 cm comprised 70.3 percent of the fish caught. The average length was 125 cm. Males were larger than females. The body length of the bigeyed tuna ranged from 54 to 193 cm, averaging 135 cm. The weight of the yellowfin tuna in the studied region ranged from 4 to 71 kg (m = 40.3). That of the bigeyed tuna – from 4 to 140 kg (m = 53.0). Male yellowfin tuna weigh more than females by an average of 4 kg, and in bigeyed tuna - by 13 kg. There are more males than females in the stocks of yellowfin and bigeyed tunas, and this predominance is expressed to a greater degree in the bigeyed tuna. Pre-spawning and spawning stocks of yellowfin and bigeyed tunas were caught throughout the fishing period. Spawning is protracted in these fishes and lasts for almost the entire year in the region studied. This, plus a vast spawning area and relatively high fecundity guarantee their great abundance and stability of the stocks. The yellowfin and bigeyed tunas fed on fish and squid to an equal degree. Pelagic crabs also were taken in fairly large quantity on occasion. In order to increase the productivity of tuna-fishing base ships of the "Leninskii Luch" type, the following are necessary: a) increase from 180 to 250 the number of baskets set out each day by a boat b) provide the base ship with 6-8 vessels of the SChS or RS type; each of these vessels must set out no less than 300 longline baskets daily c) insure around-the-clock work for the technological department of the base ship. -- Robert M. Howland

11308. Mosher, Kenneth H. (Bureau of Commercial Fisheries Biological Laboratory, Seattle, Washington). 1969. IDENTIFICATION OF PACIFIC SALMON AND STEELHEAD TROUT BY SCALE CHARACTERISTICS. United States Department of the Interior, U. S. Fish and Wildlife Service, Bureau of Commercial Fisheries, Circular 317.

Descriptions and illustrations of the scales of each species, a key to identifying species by use of scale characters, and a section on the appearance of juvenile salmon scales are presented. (Auth.)

11309. Pinder, Lesley J., and J. G. Eales (Univ. of New Brunswick, Fredericton, N. B., Canada). 1969. SEASONAL BUOYANCY CHANGES IN ATLANTIC SALMON (Salmo salar) PARR AND SMOLT. J. Fish. Res. Bd. Canada, 26(8): 2093-2100.

A population of yearling Atlantic salmon parr was held in the laboratory from July to June in a negligible current at seasonal temperatures and photoperiods. Indirect measurements of swimbladder volume (pressure of neutral buoyancy) were made monthly on groups of 14-20 fish held for 24 hr either in still water or in current (0.13 m/sec). Parr were consistently less buoyant in the current than in still water. However, seasonal changes occurred, particularly in the current. For parr in a current, buoyancy was lowest in early winter but increased throughout the spring until the parr-smolt transformation, when smolts in the current were just as buoyant as smolts in still water. The seasonal development of smolt buoyancy in a current was related to body size and water temperature but did not seem to be affected by photoperiod. The seasonal changes in swimbladder volume were not significantly correlated with tissue density (density of the gas-free fish), which in turn was not significantly correlated with the level of ether-extractable fat. However, the level of ether-extractable fat was significantly correlated with the coefficient of condition. At parr-smolt transformation, tissue density, level of ether-extractable fat, and coefficient of condition decreased sharply. (Authors)

11310. Oshima, Kiyoshi, William E. Hahn, and Aubrey Gorbman. (Dept. of Zoology, Univ. of Washington, Seattle, Washington). 1969. OLFACTORY DISCRIMINATION OF NATURAL WATERS BY SALMON. J. Fish. Res. Bd. Canada, 26(8): 2111-2121.

Three sets of experiments are described, all based on the electrical responses recorded in the olfactory bulb of salmon (Oncorhynchus tshawytscha and O. kisutch) when various natural waters, or modified natural waters, were infused into the nostril. In the first experiments it was found that, generally, the most vigorous responses were evoked by waters in which the tested salmon had never been. However, an exceptional situation was found in which a strange water (Issaquah River) evoked olfactory responses in Soos Creek and University of Washington salmon that could not be distinguished from the home water response. Chinook salmon that had been reared in a freshwater hatchery for 2 years and then placed in sea water for 2 weeks retained their home water response in sea water. Placing chinook salmon in a small volume of fresh water, which had previously evoked only a slight bulbar electroencephalographic (EEG) response, rendered the water highly stimulatory. Keeping coho salmon under the same conditions did not make the water as stimulatory. Two-year-old adult chinook salmon placed in a new environmental water that was relatively weakly stimulatory at first developed a bulbar EEG response to the novel water in 3 days that was not distinguishable from the home water response. (Authors)

11311. Oshima, Kiyoshi, William E. Hahn, and Aubrey Gorbman. (Dept. of Zoology, Univ. of Washington, Seattle, Washington). 1969. ELECTROENCEPHALOGRAPHIC OLFACTORY RESPONSES IN ADULT SALMON TO WATERS TRAVERSED IN THE HOMING MIGRATION. J. Fish. Res. Bd. Canada, 26(8): 2123-2133.

By infusing various natural waters into noses of homing salmon (Oncorhynchus tshawytscha and O. kisutch) and recording electroencephalographic (EEG) patterns from the olfactory bulb, data were collected showing responsiveness to waters along the fresh water migratory route. The largest responses always were evoked by the home water for each of the three spawning groups. Generally, the responses to various waters along the migrating route were equivalent, or did not vary in any recognizable progression. Accordingly, it does not seem that homing salmon are following a single olfactory clue in increasing concentration. Instead, they appear to be responding olfactorily to individual loci along the route. (Authors)

11312. Patalas, K. (Fisheries Research Board of Canada, Freshwater Institute, Winnipeg 19, Man., Canada). 1969. COMPOSITION AND HORIZONTAL DISTRIBUTION OF CRUSTACEAN PLANKTON IN LAKE ONTARIO. J. Fish. Res. Bd., Canada, 26(8): 2135-2164.

The horizontal distribution of planktonic crustaceans was determined in Lake Ontario at monthly intervals from June to October 1967, based on net hauls from 50 to 0 m at 32-62 stations. A separate study conducted over a 24-hr period at one station showed that on the average 90% of the zooplankters occupied the 0-50-m stratum through which the net was hauled. Eleven species of copepods and 11 species of cladocerans were found. The most abundant forms were Cyclops bicuspidatus thomasi, Daphnia retrocurva, Bosmina longirostris, Bosmina coregoni coregoni, Tropocyclops prasinus mexicanus, and Ceriodaphina lacustris. Most species appeared in the collections during June-July in the eastern part of the lake with abundance patterns later moving westward, contrary to the general movement of wind and water. At the time of maximal population density there was a strong positive correlation between zooplankton abundance and heat content of the water column from 0 to 25 m. The eastern part of the lake averaged 1.7 times more specimens/cm^2 than the western part of the lake. Upwelling was responsible for low numbers of zooplankters along the northwestern shore. Abundance patterns similar to generalized current flows were observed in the northern and southern parts of the lake. Flow from the Niagara River was associated with increased abundance of zooplankters in spring and summer, but decreased abundance in autumn. A detailed study of the abundance and distribution of zooplankton offshore from Toronto Harbour showed that harbour water does influence zooplanktonic populations in the vicinity. Temperature and depth of the epilimnion as influenced by the general direction of wind motion were key factors in understanding the zooplanktonic community of Lake Ontario. (Auth.)

11313. Chaston, I. (Dept. of Zoology, Univ. of Exeter, Exeter, Devon, England). 1969. SEASONAL ACTIVITY AND FEEDING PATTERN OF BROWN TROUT (Salmo trutta) IN A DARTMOOR STREAM IN RELATION TO AVAILABILITY OF FOOD. J. Fish. Res. Bd. Canada, 26(8): 2165-2171.

In laboratory tests, brown trout were most active between dusk and dawn from spring to autumn, but the percentage of the total activity that occurred during daylight was higher in the summer than in the other two seasons. Analysis of the variation in the weight of stomach contents during 24 hr in the three seasons showed a higher peak in weight at noon in summer than in the other seasons. The difference was related to an increased consumption of material of terrestrial origin, which other work showed to be most available to the fish between 09.00 and 12.00 hr. No relationship was found between the times of maximum occurrence of benthic and emergent items in the stream and of their consumption by trout. The increase in daytime activity during the summer was also evidently related to increased consumption of terrestrial material. (Auth.)

11314. Matton, Pierre, and Quentin N. LaHam. (Dept. of Biology, Univ. of Ottawa, Ottawa, Ont., Canada). 1969. EFFECT OF THE ORGANOPHOSPHATE DYLOX® ON RAINBOW TROUT LARVAE. J. Fish. Res. Bd. Canada, 26(8): 2193-2200.

Organophosphate poisoning in fish and mammals has always been associated with the inhibition of acetylcholinesterase in both neuromuscular and brain tissues. This inhibition resulted in the apparent death of the organisms by asphyxia. Rarely have other effects been reported. In the present study, 1-inch rainbow trout larvae were treated for 16 hr with from 10 to 100 ppm Dylox®, or for 40 hr with 5 ppm. This treatment produced a marked acetylcholinesterase inhibition that was reflected by their abnormal behavior patterns. Histological examination revealed pathological changes in the heart, liver, blood cells, pseudogills, and muscular tissues; this pathology could not be explained on the basis of acetylcholinesterase inhibition. (Authors)

11315. Hasler, Arthur D., Edward S. Gardella, Ross M. Horrall, and H. Francis Henderson. (Laboratory of Limnology, Univ. of Wisconsin, Madison, Wisc.) 1969. OPEN-WATER ORIENTATION OF WHITE BASS, Roccus chrysops, AS DETERMINED BY ULTRASONIC TRACKING METHODS. J. Fish. Res. Bd. Canada, 26(8): 2173-2192.

In the spring and summer of 1965, 26 white bass, Roccus chrysops (Rafinesque), were displaced to open water on Lake Mendota, Wisconsin, and their paths traced by means of ultrasonic transmitters carried in the stomachs of the fish and receiving gear located on boats. Seventeen fish captured by fyke nets on their spawning ground were displaced 1.6 km west-southwest to a mid lake release point. Two months after the spawning season nine fish, captured by hook-and-line, were displaced 3.1 km east-northeast from their capture area to the same release point. The mean tracking time for all 26 fish was 7.31 hr. Both the spawning and nonspawning fish maintained steady courses over long distances, and both groups showed a distinct directional preference for the eastern half of the lake where the spawning grounds are located. This open-water orientation helps explain the rapid homing performance, observed in previous experiments, of displaced spawning white bass, and also demonstrates that white bass possess mechanisms for orienting to directional cues present in their natural environment. Water currents, wind-generated surface waves, and the sun were examined as possible directional cues used by the fish. Although there was some evidence supporting the use of each of these cues, the problem of orientation mechanisms remains obscure. It was determined, however, that the observed movements of the fish cannot be explained as simply passive drift by the water currents. (Authors)

11316. Manzer, J. I. (Fisheries Research Bd. of Canada, Biological Station, Nanaimo, B. C., Canada). 1969. STOMACH CONTENTS OF JUVENILE PACIFIC SALMON IN CHATHAM SOUND AND ADJACENT WATERS. J. Fish. Res. Bd. Canada, 26(8): 2219-2223.

Stomach contents of young Pacific salmon in Chatham Sound and adjacent waters of northern British Columbia from June through August indicated interspecific differences in the kinds of organisms consumed. Pinks (Oncorhynchus gorbuscha) and chums (O. keta) were mainly planktophagous, copepods and Larvacea (Oikopleura spp.) being most important; cohos (O. kisutch) were piscivorous, herring larvae (Clupea spp.) and sand lance (Ammodytidae spp.) being important; sockeye (O. nerka) were mainly planktophagous but fish also were important. With pinks and chums, while they were still relatively abundant along the beaches, the dominant food item progressively changed from copepods in the southern areas to Larvacea in the northern areas. (Auth.)

11317. Gee, J. H., and V. G. Bartnik. (Dept. of Zoology, Univ. of Manitoba, Winnipeg, Man., Canada). 1969. SIMPLE STREAM TANK SIMULATING A RAPIDS ENVIRONMENT. J. Fish. Res. Bd., Canada, 26(8): 2227-2230.

The construction of an inexpensive stream tank providing a rapids environment of 0.6 m^2 with a maximum velocity of 0.5 m/sec is described. Compressed air and a large aquarium are required to create an adequate volume of flow. (Authors)

11318. Lightner, Donald, and George Post (Dept. of Fishery and Wildlife Biology, Colorado State University, Fort Collins, Colo.). 1969. MORPHOLOGICAL CHARACTERISTICS OF INFECTIOUS PANCREATIC NECROSIS VIRUS IN TROUT PANCREATIC TISSUE. J. Fish. Res. Bd., Canada, 26(8): 2247-2250.

Electron microscopical observations were made of infectious pancreatic necrosis (IPN) virus in thin sections of pancreatic acinar cells of rainbow trout (Salmo gairdneri). The virus and trout used in this study were obtained from a naturally occurring IPN eipzootic in Colorado trout hatcheries and rearing units in 1968. IPN virus particles were found in large numbers in pancreatic acinar cells. Virus particles were associated most often with inclusion bodies composed of masses of virus particles and cell debris or large crystalline aggregations that were encircled by a single-layered membrane. Mature virus particles were found to average 57 mm in diameter and were hexagonal in profile. (Authors)

11319. Orr, T. S. C., and C. A. Hopkins (Wellcome Laboratories for Experimental Parasitology, Univ. of Glasgow, Bearsden, Glasgow, Scotland). 1969. MAINTENANCE OF THE LIFE CYCLE OF Ligula intestinalis IN THE LABORATORY. J. Fish. Res. Bd. Canada, 26(8): 2250-2251.

Techniques for the maintenance of the life cycle of Ligula intestinalis in the laboratory are described. Fertile eggs were produced by adult cestodes 72 hr after ducklings were fed with infective plerocercoids. Eggs were extracted by sieving and washed by decanting prior to incubation in water for 10 days at 25C. A bright light stimulated developed eggs to hatch, and the emergent coracidia were fed to the copepods Diaptomus fragilis and Mesocyclops leuckarti. Infective procercoids were present in the haemocoel of copepods after 10 days at 25C. Plerocercoids developed in tropical cyprinid fish, e.g., Danio malabaricus, which were infected by exposure to infective copepods. (Authors)

11320. Muth, K. M. (Fisheries Research Board of Canada, Arctic Biological Station, Ste. Anne de Bellevue 800, Quebec, Canada). 1969. AGE AND GROWTH OF BROAD WHITEFISH, Coregonus nasus, IN THE MACKENZIE AND COPPERMINE RIVERS, N.W.T. J. Fish. Res. Bd., Canada, 26(8): 2252-2256.

Broad whitefish, Coregonus nasus, from the Coppermine River differ in both rate of growth and longevity from those in the Mackenzie River. Whitefish from the Mackenzie River are faster growing during the first 6 years of life but have a shorter life span than whitefish from the Coppermine River. Mackenzie River data correspond favorably with age and growth of broad whitefish reported from several rivers in the USSR. Differences in environmental factors such as water temperature, ice conditions, and food species availability are suggested as causes for fish growth differences in the two rivers. (Auth.)

11321. Allen, K. Radway (Fisheries Research Bd. of Canada, Biological Station, Nanaimo, B.C., Canada). 1969. APPLICATION OF THE BERTALANFFY GROWTH EQUATION TO PROBLEMS OF FISHERIES MANAGEMENT: A REVIEW. J. Fish. Res. Bd. Canada, 26(9): 2267-2281.

The development of large modern fisheries has led to the overexploitation, with resulting less than optimal production, of many of our fish stocks. A need to develop management techniques which would make it possible to hold stocks and exploitation rates more nearly at optimal levels has led to the development and extensive study of mathematical theory relating to fishing. An essential feature of this theory is the yield equation which relates the obtainable yield to such stock parameters as the number of recruits, rate of growth at various stages of life, natural mortality rate, and intensity of fishing. A widely used form of the yield equation is that developed by Beverton and Holt. In this equation, the growth component is represented by the well-known Bertalanffy growth equation:

$$W_t = W_\infty (1-e^{-K(t-to)})^3.$$

It is not possible, however, to represent the growth of all fish satisfactorily by this equation, and where this is not possible, the Beverton and Holt yield equation also does not give satisfactory results. This situation calls for the need to develop a more generalized equation, using a more widely applicable form of the growth curve. As Bertalanffy has pointed out, the original equation assumes that catabolic processes are proportional to the weight of the animal, whereas anabolic processes are assumed to be proportional to the surface area or to the 2/3 power of the weight, but in practice at least the latter relationship frequently does not hold. The present paper examines the effect of different values of the exponent in the catabolic and anabolic components of the growth equation upon the shape of the growth curve and particularly upon the proportion of final size at which the point of inflection occurs. The modified yield equation embodying the generalized growth equation can be solved by means of tables of the incomplete beta-function by an extension of the method of Jones. (Auth.)

11322. McFadden, T. W. (Laboratory for Experimental Limnology, R.R. #2, Maple, Ontario, Canada). 1969. EFFECTIVE DISINFECTION OF TROUT EGGS TO PREVENT EGG TRANSMISSION OF Aeromonas liquifaciens. J. Fish Res. Bd. Canada, 26(9): 2311-2318.

Treatment of trout eggs with classical disinfectants such as sulfo-merthiolate, merthiolate, and acriflavine proved unreliable for destroying Aeromonas liquefaciens on the eggshell. These bacteristatic agents washed free leaving viable bacteria on the shell. An organic iodine compound, povidone-iodine, was found to be bactericidal at dosages readily tolerated by trout eggs. No reduction in the rate of development was observed after treatment. Transmission of A. liquefaciens from parents to offspring follows the route reported for Aeromonas salmonicida. Viable bacterial cells are carried on the outer surface of the shell only, enabling the use of surface disinfection. (Auth.)

11323. Arai, Hisao P. (Fisheries Res. Bd. of Canada, Biological Station, Nanaimo, B. C., Canada). 1969. PRELIMINARY REPORT ON THE PARASITES OF CERTAIN MARINE FISHES OF BRITISH COLUMBIA. J. Fish. Res. Bd. Canada, 26(9): 2319-2337.

The results of a study to assess the kinds and degrees of parasitism that exist in or on inshore fishes of British Columbia are presented. The report contains a listing of 68 taxa of parasites recovered from a total of 814 host specimens representing 61 species. Observations on host-parasite relationships made during the course of the study are discussed. (Auth.)

11324. Wilson, Dennis C., and Raymond E. Millemann. (Dept. of Fisheries and Wildlife, Oregon State University, Marine Science Center, Newport, Oregon). 1969. RELATIONSHIPS OF FEMALE AGE AND SIZE TO EMBRYO NUMBER AND SIZE IN THE SHINER PERCH, Cymatogaster aggregata. J. Fish. Res. Bd., Canada, 26(9): 2339-2344.

Ages, lengths, and weights were determined for 124 female shiner perch, Cymatogaster aggregata Gibbons, collected in Yaquina Bay, Oregon, from May 17 through June 29, 1968. Embryos (1005) were obtained from 111 gravid females either by dissection (737) or at parturition in the laboratory (268). Embryo lengths, weights, and numbers per female parent were determined. As females increased in age from 1 to 6 years, their mean fork length increased from 9.32 to 13.65 cm, their weight from 13.65 to 47.78 g, and the mean number of embryos per parent female increased from 5.83 to 20.00. The equations and their correlation coefficients (R) computed for the relationships of embryo number (Y) to parent female fork length, weight, and age are, respectively: $\log Y = -1.892 + 2.735 \log X$ ($R = 0.89$); $Y = 1.131 + 0.313 X$ ($R = 0.70$); and $Y = 4.23 + 1.73 X$ ($R = 0.51$). Embryo size at birth was also directly related to female parent size. The equations computed for the relationship of total length of embryo at birth (Y) to parent female fork length and parent female weight are, respectively: $Y = 24.211 + 1.620 X$ ($R = 0.79$); and $Y = 0.384 + 0.015 X$ ($R = 0.72$). The equation computed for the relationship of embryo weight (Y) to embryo length at birth is $Y = -2.266 + 0.712 X$ ($R = 0.95$). (Authors)

11325. Platt, Trevor, Vivien M. Brawn, and Brian Irwin. (Fisheries Res. Bd. of Canada, Marine Ecology Lab., Bedford Institute, Dartmouth, N. S., Canada). 1969. CALORIC AND CARBON EQUIVALENTS OF ZOOPLANKTON BIOMASS. J. Fish. Res. Bd. Canada, 26(9): 2345-2349.

In a study throughout 1 year at a station in St. Margaret's Bay, N. S., the caloric content per unit dry weight of zooplankton showed a fivefold variation. Along with all the available information from the literature, the data indicated that the dependence of caloric content of zooplankton (y) on per cent organic matter (x) could be described by the equation $y = -3370 + 136x - 0.514x^2$. The caloric content may be predicted from per cent ash (A) and per cent carbon (C) by the equation $y = 1351 + 106C - 21.2A$. The relative stability of the caloric or carbon standing stock of zooplankton per unit water volume, compared with numbers or dry weight, may be an indication of some kind of regulatory mechanism controlling energy flow. (Authors)

11326. Tsuyuki, H., E. Roberts, and E. A. Best. (Fisheries Res. Bd. of Canada, Vancouver Laboratory, Vancouver 8, B. C., Canada). 1969. SERUM TRANSFERRIN SYSTEMS AND THE HEMOGLOBINS OF THE PACIFIC HALIBUT (Hippoglossus stenolepis). J. Fish. Res. Bd., Canada, 26(9): 2351-2362.

Based on starch-gel electrophoretic analyses of serum proteins of 1092 specimens of Pacific halibut sampled from the eastern Bering Sea and northeastern Pacific Ocean southward to southern British Columbia, three molecular species of transferrins were encountered. A fourth rare type was postulated to explain the observation of some phenotypes involving this transferrin. These transferrins, either singly or in combinations of two, accounted for the theoretically possible 10 phenotypes of which 8 were actually observed Hereditary control by four codominant alleles (Tf^A, Tf^B, Tf^C, and Tf^D) is postulated to explain the heterogeneity of the transferrin patterns. The collections were arbitrarily divided into 10 geographic areas and gene frequency analyses were used to determine population structure. Phenotypic distribution was shown to be independent of age and sex. Of the 10 areas, only the collection from southeastern Alaska proved not to be homogeneous. Preliminary analysis of blood hemoglobins indicated that these proteins are not of value in population analyses. (Authors)

11327. Brett, J. R., J. E. Shelbourn, and C. T. Shoop. (Fisheries Res. Bd. of Canada, Biological Station, Nanaimo, B. C., Canada). 1969. GROWTH RATE AND BODY COMPOSITION OF FINGERLING SOCKEYE SALMON, Oncorhynchus nerka, IN RELATION TO TEMPERATURE AND RATION SIZE. J. Fish. Res. Bd., Canada, 26(9): 2363-2394.

The growth of young sockeye salmon (Oncorhynchus nerka) was studied at temperatures ranging from 1 to 24 C in relation to rations of 0, 1.5, 3, 4.5, and 6% of dry body weight per day, and at an "excess" ration. Optimum growth occurred at approximately 15 C for the two highest rations, shifting progressively to a lower temperature at each lower ration. The maximum growth rate for sockeye 5-7 months old was 2.6%/day; that for fish 7-12 months old was 1.6%/day. At 1 C a ration of 1.5%/day was sufficient to provide for a maximum growth rate of 0.23%/day. The maintenance ration was found to increase rapidly above 12 C, amounting to 2.6%/day at 20 C. No growth took place at approximately 23 C despite the presence of excess food. Isopleths for gross and net food-conversion efficiencies were calculated. A maximum gross efficiency of 25% occurred in a small area with a center at 11.5 C and a ration of 4.0%/day; a maximum net efficiency of 40% occurred within a range of 8-10 C for rations of 1.5%/day down to 0.8%/day, the maintenance level. Gross body constituents changed in response to the imposed conditions, varying in extreme from 86.9% water, 9.4% protein, and 1.0% fat for starved fish at 20 C to 71.3% water, 19.7% protein, and 7.6% fat on an excess ration at 15 C. It is concluded on the basis of growth and food-conversion efficiency that temperatures from 5 to 17 C are most favorable for young sockeye, and that a general physiological optimum occurs in the vicinity of 15 C. (Authors)

11328. Culley, Dudley D., Jr., and Denzel E. Ferguson. (Dept. of Zoology, Mississippi State Univ. State College, Mississippi). 1969. PATTERNS OF INSECTICIDE RESISTANCE IN THE MOSQUITOFISH, Gambusia affinis. J. Fish. Res. Bd. Canada, 26(9): 2395-2401.

The extent of insecticide resistance in a resistant population of mosquitofish (Gambusia affinis) from Belzoni, Mississippi, was compared with that of a susceptible population from State College, Mississippi, using 28 insecticides of five major groups. Results of 48-hr bioassays show that resistant mosquitofish have developed high resistance only to the toxaphene-endrin related insecticides, even though insecticides from other groups were heavily applied. Spray records for the Belzoni area and insecticide characteristics such as stability and toxicity aided in evaluating cross-resistance patterns in the resistant population. Patterns of resistance in mosquitofish are similar to those in many resistant arthropods. (Authors)

11329. Budd, J. C., F. E. J. Fry, and P. S. M. Pearlstone. (Research Branch, Ontario Dept. of Lands and Forests, Maple, Ont., Canada). 1969. FINAL OBSERVATIONS ON THE SURVIVAL OF PLANTED LAKE TROUT IN SOUTH BAY, LAKE HURON. J. Fish. Res. Bd., Canada, 26(9): 2413-2424.

Yearling lake trout were planted in South Bay, Lake Huron, an area with a sea lamprey population, each year from 1949 to 1955 with the exception of 1950. Fish were recaptured in pound and gillnets. Those recaptured in pound nets were tagged and released. Data from recaptures of tagged fish have been used to calculate yearly population estimates that were used to determine the annual mortality of certain year-classes. The fish were also examined for lamprey wounds and scars and the results tabulated according to the age of the fish. Before age IV annual mortality of South Bay lake trout does not appear to differ significantly from annual mortalities observed in lake trout populations in the absence of sea lampreys. Thereafter, annual mortality rates rise sharply and the population disappears at the age of VI or VII. No spawning population was maintained. Prior to age III no lamprey marks were observed on recaptured lake trout. From ages III to V the percentages of fish bearing lamprey marks increased from 5.2 to 38.8. This trend may continue through age VI but too few data are present to be certain. Before age VI there appears to be a direct correlation between annual lamprey marking rates and annual natural mortality rates. (Authors)

11330. Eastman, Joseph T. (Dept. of Zoology, Univ. of Minnesota, Minneapolis, Minn.). 1969. PROGRESSIVE CHANGES IN THE VENTRAL AORTA OF THE CARP, Cyprinus carpio. J. Fish. Res. Bd., Canada, 26(9): 2425-2430.

Early arteriosclerosis was found in the curved region of the ventral aorta of the carp, Cyprinus carpio Linnaeus, older specimens showing a greater degree of involvement than younger specimens. The progressive pathological changes are attributable to the length of time that a particular set of hemodynamic conditions, resulting in a suction on the inner wall of the arterial curve, have been operating.

11331. Mount, Donald I., and Charles E. Stephan. (Federal Water Pollution Control Administration, U. S. Dept. of the Interior, Newtown Fish Toxicology Lab., Cincinnati, Ohio). 1969. CHRONIC TOXICITY OF COPPER TO THE FATHEAD MINNOW (Pimephales promelas) IN SOFT WATER. J. Fish. Res. Bd., Canada, 26(9): 2449-2457.

The maximum acceptable toxicant concentration of copper for the fathead minnow (Pimephales promelas, Rafinesque) in water having an EDTA hardness of 30 mg/liter (as $CaCO_3$) was found to be between 0.13 and 0.22 of the 96-hr TL_m value, using survival, growth, and reproduction to evaluate effect. In an earlier study the application factor for copper in water with an EDTA hardness of 200 mg/liter (as $CaCO_3$) was found to be between 0.03 and 0.08 for the same species. Suggestions are made that should increase the accuracy and precision of future determinations of application factors. (Authors)

11332. Wolf, Ken, and M. C. Quimby. (Bur. of Sport Fisheries and Wildlife, Eastern Fish Disease Lab., Kearneysville, West Virginia). 1969. INFECTIOUS PANCREATIC NECROSIS: CLINICAL AND IMMUNE RESPONSE OF ADULT TROUTS TO INOCULATION WITH LIVE VIRUS. J. Fish. Res. Bd., Canada, 26(9): 2511-2516.

Mature feral rainbow trout were inoculated with infectious pancreatic necrosis (IPN) virus and held at 12.5 C for 3 months to produce antibody and to determine whether or not disease would occur. Disease was not observed, but IPN virus-neutralizing antibody was found in pre-inoculation serum indicating the likelihood of prior infection. As measured by Neutralization Index, the immune response varied from weak to very strong. Neutralizing antibody was not found in sera from mature specific pathogen-free rainbow and brook trout. Although IPN virus also failed to produce clinical disease in adult brook trout it did establish a transient asymptomatic infection, and this resulted in high levels of neutralizing antibody. (Authors)

11333. Davis, Charles C. (Marine Sciences Res. Lab. and Dept. of Biology, Memorial Univ. of Newfoundland, St. John's, Nfld., Canada). 1969. SEASONAL DISTRIBUTION, CONSTITUTION, AND ABUNDANCE OF ZOOPLANKTON IN LAKE ERIE. J. Fish. Res. Bd., Canada, 26(9): 2459-2476.

Zooplankton samples, collected by vertical hauls from near bottom to the surface, were obtained from 28 stations along the length of Lake Erie in October 1967. A partial similar series, confined largely to the Western Basin because of ice conditions, was collected in January 1968. The results of the analyses are tabulated as numbers of individuals per m^3, and are discussed. Comparisons are made with results previously published for a comparable series of stations visited in July 1967. As in July, distinct differences were to be seen among the three major basins (Western, Central, and Eastern) in the October results. These differences are summarized. In July an expected decrease in zooplankton, such as would be predicted from lake morphology, amount of runoff from rivers, etc., occurred from west to east in the lake. In October, however, the zooplankton of the Western Basin was extremely impoverished, and the expected distribution of biomass was reversed. It is shown, on the other hand, from work done by others on samples taken from the same series of stations in October, that phytoplankton, chlorophyll *a*, and seston exhibited the expected distribution, emphasizing the danger of judging an ecosystem by the examination of only limited components of the community and at single periods of the year. In July the bulk of the zooplankters consisted of large cladocerans (especially daphnids) and copepods. In October there were much larger populations of rotifers and of small cladocerans (Bosmina, Chydorus). Copepods were relatively sparse. The January samples were characterized by greater numbers and a greater variety of diaptomids than in October, and the rotifers remained very important. All of the January samples contained many partially decayed microcrustaceans. This was interpreted as indicating a seasonal die-off associated with the very severe weather of the period. (Auth.)

11334. Dorfman, D., and W. R. Whitworth. (Univ. of Connecticut, College of Agriculture, Storrs, Conn.). 1969. EFFECTS OF FLUCTUATIONS OF LEAD, TEMPERATURE, AND DISSOLVED OXYGEN ON THE GROWTH OF BROOK TROUT. J. Fish. Res. Bd., Canada, 26(9): 2493-2501.

Slug doses of lead administered once a day 5 days/week to brook trout exposed to simultaneous diel fluctuations of dissolved oxygen and temperatures showed that concentrations of 25 mg/liter of lead reduced growth. Concentrations of 15 mg/liter had little apparent effect and concentrations of 10 mg/liter had no deleterious effects on growth. (Authors)

11335. Nyman, O. L. (Fisheries Res. Bd. of Canada, Biological Station, St. John's, Nfld., Canada). 1969. POLYMORPHIC SERUM ESTERASES IN TWO SPECIES OF FRESHWATER FISHES. J. Fish. Res. Bd., Canada, 26(9): 2532-2534.

Two simple, genetically determined serum esterase polymorphisms, suited for population analysis, are described in two species of freshwater fishes, white bream (Abramis blicca B.) and ruff (Acerina cernua L.). In both instances the synthesis of the enzyme bands was found to be controlled by two allelic codominant genes, which also in both instances were kept in equilibrium. Gene frequency data are presented from one population of each species. (Auth.)

11336. Pippy, J. H. C. (Fisheries Res. Bd. of Canada, Biological Station, St. Andrews, N. B., Canada). 1969. KIDNEY DISEASE IN JUVENILE ATLANTIC SALMON (Salmo salar) IN THE MARGAREE RIVER. J. Fish. Res. Bd., Canada, 26(9): 2535-2537.

Bacterial kidney disease was presumptively identified in each of 25 hatchery-reared juvenile salmon (Salmo salar) but in only 2 of 235 wild juveniles in the Margaree River system. Apparently spread of disease from the hatchery to wild salmon in the river is very gradual. (Auth.)

11337. MacKay, K. T., and E. T. Garside. (Dept. of Biology, Dalhousie Univ., Halifax, N. S., Canada). 1969. MERISTIC ANALYSES OF ATLANTIC MACKEREL, Scomber scombrus, FROM THE NORTH AMERICAN COASTAL POPULATIONS. J. Fish. Res. Bd., Canada, 26(9): 2537-2540.

Mean counts of vertebrae, of anal and soft dorsal fin rays, and of peduncular finlets were identical in samples of Atlantic mackerel, Scomber scombrus, from the northern and southern breeding populations in the northwest Atlantic Ocean. This information, together with growth rates and biochemical evidence from the literature, suggests that although the populations occupy separate spawning regions there is sufficient exchange of individuals at other seasons to maintain considerable genetic continuity. (Authors)

11338. Arnold, Dean E., 1969. THE ECOLOGICAL DECLINE OF LAKE ERIE. N. Y. Fish and Game Journal, 16(1): 27-45.

Changes in Lake Erie due to natural processes and the activities of man are discussed with respect to geology, hydrology, pollution, chemistry, plankton, benthos and fisheries. In all of these areas, it is shown that many changes have taken place and that the rate of change has accelerated in recent years. Most of these changes are harmful to the lake's value as a resource for man and as a habitat for its natural fauna. Several proposed ideas for reversing this trend are reviewed. (Auth.)

11339. Finkelstein, Samuel L. (Senior Aquatic Biologist (Marine) N. Y. State Conservation Dept.). 1969. AGE AND GROWTH OF SCUP IN THE WATERS OF EASTERN LONG ISLAND. N. Y. Fish and Game Journal, 16(1): 84-110.

From May 1964 through September 1966, age and growth data were obtained for more than 3,000 scup collected with different types of gear at several locations in the waters of eastern Long Island. Scale annuli were identified and, based on the time of formation and their location on the scale, were considered to be valid indicators of age. Fish lengths were back-calculated, and the average growth rates for males and females were determined. The size and age composition of the fish collected are presented and discussed. While additional biological information would be required for full evaluation, it appears that the present minimum size (7 inches) for scup that may be legally bought and sold is of doubtful value. (Auth.)

11340. Hoff, James G., and Mark Chittenden. (Dept. of Biology, Southeastern Massachusetts Technological Institute). 1969. OXYGEN REQUIREMENTS OF THE WALLEYE. N. Y. Fish and Game Journal, 16(1): 125-126.

11341. Culley, Dudley D. and Howard G. Applegate (Mississippi State Univ., State College, Mississippi). 1967. RESIDUES IN FISH, WILDLIFE, AND ESTUARIES. INSECTICIDE CONCENTRATIONS IN WILDLIFE AT PRESIDIO, TEXAS. Pesticides Monitoring Journal, 1(2):21-28.

Data are given on insecticide concentrations in representative species of reptiles, birds, and mammals from Presidio, Texas. Various tissues and organs were examined by the means of gas chromatography. As specimens were taken farther from the cultivated area, the insecticide concentrations decreased. Within and adjacent to the cultivated area, insecticide concentrations showed a complex pattern. Possible reasons for the complexity are discussed. (Authors)

11342. Bagenal, T. B. (The Ferry House, Ambleside, Westmorland, England). 1969. THE RELATIONSHIP BETWEEN FOOD SUPPLY AND FECUNDITY IN BROWN TROUT Salmo trutta L., J. Fish Biol. (1969) 1, 167-182.

11343. Judd, C. Edward and Frank B. Cross. 1969. TISSUE-DAMAGE IN LIVERS OF CHANNEL CATFISH, Ictalurus punctatus, RAISED ON ARTIFICIAL DIETS IN PONDS. Kansas Academy of Science, 69(1): 48-57.

11344. Hewston, John G. and Donald R. Franklin (Div. of Natural Resources, Humboldt State College, Arcata, Calif.). 1969. RECREATIONAL USE PATTERNS AT FLAMING GORGE RESERVOIR, 1963-1965. U. S. Dept. of the Interior, Fish and Wildlife Service, Bureau of Sport Fisheries and Wildlife, RP-70.

Activities, characteristics, and satisfactions of recreationists at Flaming Gorge Reservoir, Utah-Wyoming, were studied in 1963-1965. Data were collected from interviews, questionnaires, creel censuses, and administrative agency records. Number of visits increased from an estimated 231,065 in 1963, the year the reservoir began to fill, to 521,843 in 1964 and 786,103 in 1965. Utah residents were present in 68 percent of the parties in 1963 and in 82 percent in 1964 and 1965. Wyoming, Colorado and California were the only other States contributing large numbers of visitors. In 1963, 56 percent of the parties came primarily to sight-see, but fishing for rainbow trout (Salmo gairdneri) became the most important primary purpose of visit during the following two years, when 42 and 37 percent came to fish. Sight-seeing was second in 1964 and 1965, with 37 and 36 percent coming primarily for that reason. Sight-seeing was the major general activity of visiting parties each year, with 74, 76, and 91 percent containing members who participated. Fishing activity, expressed as percentage of visiting parties containing someone who fished in the area (tributaries, lakes, or reservoir) rose from 16 percent in 1963 to 71 and 75 percent during the following two years, when the reservoir was open to angling. Catch rates were 1.24 fish per hour in 1964 and 1.33 in 1965, but varied with type of angling and in different parts of the reservoir. Mean length of creeled trout was 11.2 inches each year and varied on different parts of the reservoir, but fish condition declined by 1965. Distribution of anglers was influenced primarily by location of access points. Other important visitor activities included camping, photography, picnicking, hiking, boating, sunbathing, swimming, nature study, water skiing and hunting. Visitors were most satisfied with scenery and weather and least satisfied with swimming areas and fish-cleaning stations. Many boat ramps were out of the water until late each summer. Campgrounds were designed primarily for tent campers and were not adequate to accommodate the average parties with more than one vehicle and other heavy, wheeled equipment. (Authors)

11345. Smith, Gordon E., and Billy G. Isom. 1967. INVESTIGATION OF EFFECTS OF LARGE-SCALE APPLICATIONS OF 2,4-D ON AQUATIC FAUNA AND WATER QUALITY. Pesticides Monitoring Journal, 1(3): 16-21.

In 1966, the Tennessee Valley Authority applied 888 tons of 20% 2,4-D butoxyethanol ester, granular herbicide to 8,000 acres of Eurasian watermilfoil growths in seven reservoirs, at rates varying from 40 to 100 lb of 2,4-D acid equivalent per acre. Laboratory analyses showed little uptake of 2,4-D by fish, but some by mussels. All mud samples contained 2,4-D in varying concentrations. Eight of nine water treatment plants sampled showed 2,4-D concentrations of less than 1 ppb. The ninth was the only plant at which 2,4-D was applied directly above the water intake supply, and its highest concentrations were 2 and 1 ppb, respectively. Extensive pre- and post-monitoring data indicate that high application rates of 2,4-D for watermilfoil control on TVA reservoirs have not produced adverse effects on aquatic fauna or water quality. (Authors)

11346. Sharpe, F. Phillip, and Walter T. Burkhard. (Bur. of Sport Fisheries and Wildlife, Fort Collins, Colorado). 1969. A LIGHTWEIGHT BACKPACK HIGH-VOLTAGE ELECTROFISHING UNIT. U. S. Dept. of the Interior, Fish and Wildlife Service, Bur. of Sport Fisheries and Wildlife, RP-78.

The object of these electrofishing investigations was to develop lightweight portable equipment for collecting fish in almost inaccessible high mountain streams. The equipment includes a lightweight variable-voltage pulsating unit, a 110-volt generator, a pack frame for mounting the equipment, and electrodes. Weighing 37 pounds, the equipment has the versatility of larger units that weigh more than 100 pounds. The backpack shocker is useful as a collecting tool in most waters having a resistance between 600 and 34,000 ohms per centimeter. It can be packed in 1-1/2 panniers and requires only two men to operate. Total cost of the

equipment is about $450. No special training is necessary for the operators other than standard safety precautions. (Authors)

11347. Beard, Thomas D. (Bur. of Research, Spooner, Wisconsin). 1969. IMPACT OF AN OVERWINTER DRAWDOWN ON THE AQUATIC VEGETATION IN MURPHY FLOWAGE, WISCONSIN. Dept. of Natural Resources RP-43, 16 p.

A lowering of the water level on Murphy Flowage during the winter of 1967-68 resulted in a significant reduction in the distribution, relative abundance and acreage of aquatic vegetation. The five species in greatest dominance before the drawdown were most affected, and collectively showed a reduction of 181.7 acres in the season after the drawdown. (Auth.)

11348. Krohn, David C. (Bur. of Research, Delafield, Wisconsin). 1969. SUMMARY OF NORTHERN PIKE STOCKING INVESTIGATIONS IN WISCONSIN. Dept. of Natural Resources RP-44, 35 p.

Information on stockings of northern pike in 19 lakes in Wisconsin, Minnesota and Iowa in past years has been compiled and presented here to evaluate various kinds of stocking efforts and to present recommendations for future stocking and further evaluation. The stocking of fingerlings and yearlings averaging 12-17 inches in total length into waters containing northern pike can result in a considerable return of the stocked fish and short-term improvement of fishing success and harvest. Generally, when northern pike populations were high, competition appeared to occur, as indicated by such factors as increased natural mortality and poor growth of stocked fish. (Auth.)

11349. Cairns, John, Jr. (Dept. of Biology, Virginia Polytechnic Institute, Blacksburg, Virginia). 1969. ECOLOGICAL MANAGEMENT PROBLEMS CAUSED BY HEATED WASTE WATER DISCHARGE INTO THE AQUATIC ENVIRONMENT. The Michigan Water Resources Commission, August 1969, p. 21-30.

Discharge of heated waste water may affect the entire aquatic ecosystem--the interrelated biological, chemical, physical system--and, if the temperature change is large, may destroy the capacity of the ecosystem to serve a variety of beneficial purposes. However, it is possible to discharge heated waste water in carefully controlled amounts without seriously degrading the aquatic ecosystem. There are four basic alternatives which are open to us with regard to the heated waste water problem which we may choose singly or in various combinations: (1) Placing all heated waste water in streams, lakes, and oceans without regard to the effects. Thus considering the environmental damage as a necessary consequence of our increased power demand. (2) Using, but not abusing, existing ecosystems. This means regulating the heated waste water discharge to fit the receiving capacity of the ecosystem. (3) Finding alternative ways to dissipate or beneficially use waste heat. (4) Modifying ecosystems to fit the new temperature conditions. We are all dependent upon a life-support system which is partly industrial and partly ecological. Unfortunately, we have reached a stage of development where the non-expandable, ecological portion of our life-support system is endangered by the expanding industrial portion. Optimal function and full beneficial use of both portions of our life-support system will only be possible if a variety of disciplines and diverse points of view can cooperate and work together effectively. Since wastes in amounts that are acceptable taken one at a time may be lethal collectively, environmental management should be on a regional basis. (Auth.)

11350. Hardisty, M. W. (School of Biological Sciences, Bath Univ. of Technology, England). 1969. A COMPARISON OF GONADAL DEVELOPMENT IN THE AMMOCOETES OF THE LANDLOCKED AND ANADROMOUS FORMS OF THE SEA LAMPREY Petromyzon marinus L. J. Fish Biol. (1969) 1, 153-166.

11351. Cope, Oliver B., Joseph P. McCraren, and Lafayette Eller, (Director, Fish-Pesticide Res. Lab., Bur. of Sport Fisheries and Wildlife, Columbia, Mo.). 1969. EFFECTS OF DICHLOBENIL ON TWO FISHPOND ENVIRONMENTS. Weed Science, 17(2): 158-165.

Pond studies were conducted at Tishomingo, Oklahoma with wettable powder 2, 6-dichlorobenzonitrile (dichlobenil) and at Denver, Colorado, with granular dichlobenil to measure chronic effects on fish and other effects on the ecosystem. Decline of the herbicide was rapid at Tishomingo, with only about 3% of the material remaining after 11 days, while at Denver the herbicide took 3 weeks to reach peak concentration in the water and was still measurable in the water after 189 days. Dichlobenil was present in bottom sediments after 312 days at Tishomingo and after 166 days at Denver. Weeds were controlled at both locations, but regrowth occurred after 3 months in ponds treated at 10 and 20 ppm dichlobenil. No immediate mortality was sustained by fish at either locality, but day-to-day mortality was serious at higher concentrations at Tishomingo. Reproduction apparently was affected by higher dichlobenil levels at Tishomingo. Growth of fish was fastest in ponds treated with highest rates of dichlobenil at Tishomingo, and slowest in the untreated ponds. Residues of dichlobenil developed in fish from all ponds, but faster at Tishomingo than at Denver, and larger in high-treatment ponds than in low-treatment ponds. Some pathology was seen in liver, kidney, and pancreas of Tishomingo fish. (Authors)

11352. Nehring, Dietwart (Institut für Binnenfischerei der Deutschen Akademie der Landwirtschaftswissenschaften zu Berlin, Abteilung für Chemie, Berlin-Friedrichshagen). 1966. INVESTIGATIONS ON THE TOXICITY OF NEW PESTICIDES AND WASTE-WATER MATERIALS AGAINST FISH. (Untersuchungen über die Toxizität neuer Pflanzenschutzmittel und Abwasserstoffe gegenüber Fischen). Zeitschrift für Fischerei und deren Hilfswissenschaften, 14(1/2): 1-7.

Extensive tests were conducted to determine the threshold values of numerous herbicides, insecticides, fungicides, and a molluscicide against fish. In addition, several sewage compounds (e. g. solvents, flotation reagents and others) were tested. The poisoning mechanism of dimethylamine is shown in detail because of its close relation to ammonia. (Auth.)

11353. Lohnisky, Karel (Abteilung für Zoologie des Kreismuseums in Hradec Králové). 1966. THE RATIO OF TOTAL LENGTH TO THE BODY LENGTH OF THE BROWN TROUT (Salmo trutta m. fario L. 1758). (Das Verhältnis der Gesamtlänge zur Körperlänge der Bachforelle (Salmo trutta m. fario L. 1758). Zeitschrift für Fischerei und deren Hilfswissenschaften, 14(1/2): 15-20.

In 447 brown trout from 14 regions of the rivers Odra, Labe, and Danube, the ratio of total length (TL) to standard length (SL) was investigated. Individually, the ratio of total length to body length varies considerably, and differs as to the origin of the fish. With increasing size of the fish the proportional difference of both lengths decreases. It was found that there is no connection between the growth rate and the relation of total length to body length. (TL - length of fish from the tip of the snout to the end of the caudal fin; SL - length of fish to the end of the urostyle). (Auth.)

11354. Lohnisky, Karel (Abteilung für Zoologie des Kreismuseums in Hradec Králové). 1966. CONTRIBUTION TO THE KNOWLEDGE OF THE GROWTH RATE OF THE BROWN TROUT (Salmo trutta m. fario L. 1758). (Beitrag zur Kenntnis der Wachstumsschnelligkeit der Bachforelle (Salmo trutta m. fario L. 1758). Zeitschrift für Fischerei und deren Hilfswissenschaften, 14(1/2): 23-34.

The author examined the growth rate of the brown trout occurring in the brooks "Cichovsky potok" and "Klapovsky potok", tributaries of the Jihlava River (Bohemian-Moravian hills, District Trebic), and in the brook Rozkos, a tributary of the Metuje River (in northeastern Bohemia). Different growth within a year-class of the trout population in the "Cichovsky potok" is caused by migration within the brook when it is temporarily short of water and into an inlet from a

nearby pond, with better food conditions. When considering the length increment of the trout from Rozkos brook, during the time after forming their last annulus on the scales until caught, these trout grew faster than those in the other waters mentioned. The relatively-slowest growth increment, observed in the "Cichovsky potok" is still better than the fastest known growth in Czechoslovakian running waters, as recorded in Vrica brook. In comparison with the literature published previously on this subject, the growth of the brown trout in all three brooks was good. (Auth.)

11355. Haider, Gerhard (Institut für Siedlungswasserbau und Wassergütewirtschaft der Technischen Hochschule Stuttgart, West Germany). 1966. CONTRIBUTIONS TO THE ANATOMY OF THE TELEOSTEAN LIVER. STUDIES ON CRUCIAN CARP (Carassius carassius L.) AND TENCH (Tinca tinca [L]). (Beiträge zur Anatomie der Teleostierleber. Untersuchungen an Karauschen (Carassius carassius L.) und Schleien (Tinca tinca [L]). Zeitschrift für Fischerei und deren Hilfswissenschaften, 14(1/2): 37-66.

The liver of the crucian carp consists of 4 well recognizable lobes (right and left main lobe, lateral ventro-lobe, and tail lobe) which all join in the liver center. The liver-gut complex of Carassius looks much like that of Cyprinus. Normally the right main lobe is not divided into an angle- or isle part. Such a division is considered to be anomalous. The arrangement of the lobes in the liver of Tinca is considerably unlike that in the liver of the carp and the crucian carp. This is caused by the different course of the gut. Regularly, there are also right and left main lobes, a lateral ventro-lobe, and a tail lobe. However, a reduction of the lateral ventro-lobe and the tail lobe occurs frequently. It is believed that the liver depends on the course of the intestine. The left main lobe of the tench is usually divided into two parts, namely: angle and isle. However, anomalies occur also in an undivided left main lobe. The tractus pneumaticus in the liver of the crucian carp has two distinct troughs: the fovea vesicalis anterior and the fovea vesicalis posterior. The tench has only the fovea vesicalis anterior. Under the microscope the liver of both species appears to be built by solid masses of hepatic cells, perforated by more or less cylindrical lacunae which contain the sinusoids. The walls which separate neighboring sinusoids (=laminae hepatis) are predominately two cells thick, but can also vary from one to many. The individual liver cells of the crucian carp seem to be a little larger than the liver cells of the tench. No lobes in the sense of the higher vertebrates could be found in the crucian carp or in the tench. Star cells, as described by KUPFFER, could be proved to exist in both species. There are three venae hepaticae in the crucian carp and in the tench. The formation of the liver vessels of both species is like that of the carp. Between the greater branches of the venae hepaticae and the liver parenchyma, an exchange of blood seems possible because the adventitia of these vessels shows a lacunal connective tissue. In both species the roots of the venae portae rise from the plexus of the submucosa, or from that between the circular and longitudinal muscles of the intestine. The branches of the venae portae of the crucian carp and the tench show a covering of pancreatic cells. In the tench these branches are usually arranged peripherically; in the crucian carp they are also found in the center of the liver lobes. The bile vessels and the liver arteries usually run near the branches of the liver veins. In both species it is difficult to show an arteria hepatica. (Auth.)

11356. Gottwald, Stanislaw, and Aleksander Winnicki. (Institut für Binnenfischerei und Landwirtschaftliche Hochschule Olsztyn-Kortowo, VR Polen, Poland). 1966. SOME OBSERVATIONS ON MALFORMATIONS OF THE EMBRYONIC MEMBRANES IN FISH. (Einige Beobachtungen über Mißbildungen der Eihüllen bei Fischen). Zeitschrift fur Fischerei und deren Hilfswissenschaften, 14(1/2): 101-110.

Observations are made concerning malformed eggshells in Coregonus albula L. and northern pike. Inner physiological changes of the organism may have caused these malformations, which may lead to a decreased hatching rate of the larvae. For this reason further research about the causative agent is desirable. (Authors)

11357. Schoffman, Robert J. (Griffin High School, Springfield, Ill.) 1968. AGE AND RATE OF GROWTH OF THE LARGEMOUTH BLACK BASS IN REELFOOT LAKE, TENNESSEE, FOR 1961 AND 1967. J. Tenn. Acad. Sci., 43(1): 2-4.

The study of age and growth of largemouth black bass in Reelfoot Lake, Tennessee, has extended over a period of thirty one years. During this period changes of growth rate have taken place. In 1937 the growth rate was above that of 1952. In 1961 the growth rate was below that of 1952. Between 1937 and 1952 the commercial fishing of largemouth black bass was abolished; this resulted in an increase in the number of largemouth black bass each year. In 1955 commercial fishing of game fish was abolished, increasing the number of all species of game fish. With the stopping of commercial fishing of game fish, the summer fishing of rough fish has decreased, with an increase in the number of rough fish. Thus the sportsmen's catches consisted mostly of small specimens. The natives and professional guides report that the spawning of largemouth black bass in the spring of 1967 was unusually good which means for the next three or four years there will be an increase of small bass caught. The decrease in the growth rate of largemouth black bass and the increasing number of small fish is in accord with the decreased growth rate of bluegills, white crappies, and channel catfish. Thus the question is: do sportsmen want small largemouth black bass or should commercial fishing of game fish be made legal? (Auth. concl.)

11358. Gray, Wilford, and Robert P. Ward. (George Peabody College for Teachers). 1968. AGE AND GROWTH RATE OF BLUEGILL IN SELECTED FARM PONDS IN OBION COUNTY, TENNESSEE. J. Tenn. Acad. Sci., 43(1): 5-6.

Differences in size, depth and age of the ponds show no significant relationship to the growth of bluegill in these ponds. Predation and nutrient enrichment appear to be most significant in regulating populations in these ponds. In the case of these particular farm ponds it appears that nutrient supply and predation determine the size and age distribution of bluegill. (Authors concl.)

11359. Fitz, Richard B. (Tennessee Valley Authority, Norris, Tenn.). 1968. FISH HABITAT AND POPULATION CHANGES RESULTING FROM IMPOUNDMENT OF CLINCH RIVER BY MELTON HILL DAM. J. Tenn. Acad. Sci., 43(1): 7-15.

Changes in the pre- and postimpoundment fish populations are evident. Although rough fish are still dominant (1967), they now account for a smaller proportion of the total population. Spawning and survival of carp, buffalo, carpsuckers, and shad were excellent the first year of impoundment. The two shads are the dominant lake species. Largemouth bass, absent in preimpoundment samples, were taken during the first spring of impoundment in abundance. White crappie, bluegill, and white bass increased in number after impoundment and this trend will probably continue. Large numbers of white bass have been taken only in the lower reaches of the lake. River herring, abundant the first year of impoundment, decreased the second year. Mooneye, numerous before impoundment, have not been taken in lake samples. Walleye showed up for the first time in October 1964, when a few harvestable-size individuals were taken. Catfish are scarce but in good condition. Water conditions are suitable for trout in the upper fifteen miles of the reservoir. Although spawning is not likely to occur, a good trout fishery can be maintained through a regular stocking program. The physical features of the lake indicate that sport fishing will not be on a par with most mainstream reservoirs. The combination of cold water temperature, low basic productivity (plankton), and relative lack of cover and wide shallow areas are not conducive to production and maintenance of a large game fish population. However, fishing success at times will probably approach that of tributary reservoirs like Norris. (Auth. concl.)

11360. Prophet, Carl W., Norman Youngstead, and LeRoy Schnittker. 1967. LIMNOLOGY OF LYON COUNTY STATE LAKE DURING REFLOODING, APRIL, 1964 - MARCH, 1966. Kansas Acad. of Science, 69(3/4): 214-225.

11361. Nowlin, William J. (Dept. of Biology, North Texas State Univ., Denton, Texas). 1968. A NEW SPECIES OF Gyrodactylus (TREMATODA: MONOGENEA) FROM THE GOLDEN SHINER. J. Tenn. Acad. Sci., 43(1): 29-30.

Gyrodactylus wellborni n. sp., a new species of monogenetic trematode from the body and fins of the golden shiner, Notemigonus crysoleucas (Mitchill) is described. The host was collected in the vicinity of Auburn, Alabama. The new species is morphologically described. (Auth.)

11362. Kariya, Teiji, Shuko Eto, and Susumu Ogasawara. 1968. STUDIES ON THE POST-MORTEM IDENTIFICATION OF THE POLLUTANT IN FISH KILLED BY WATER POLLUTION — VIII. ON ACUTE POISONING WITH PHENOL. Bull. Jap. Soc. sci. Fish., 34(9): 764-769.

In this study, an attempt was made to detect phenol in the body of fish killed by phenol solutions. The quantity of phenol was determined by the Gibbs method: dissolve the fish body in 10% sodium hydroxide; distill after acidifing with phosphoric acid; add 4 ml of buffer solution to 80 ml of distillate, and adjust pH from 9.2 to 9.6; add 2 ml of Gibbs reagent; hold the mixture for 1 hour in a 37°C incubator, and then cool to room temperature; add 20 ml of n-butyl alcohol and shake the mixture well; separate the alcohol layer, and determine light absorption at 660mμ wave length. In these experiments, the 48-hour TLm for rainbow trout, carp and Ayu fish (Plecoglossus altivelis) with phenol was about 4 ppm, 50 ppm and 9 ppm, respectively. Phenol was not present in the normal fish bodies, but it was clearly detected in the fish bodies killed by phenol solutions. It was possible to detect phenol even after washing by running tap water for 24 hours after death. Phenol was detected in the skin, muscle, gill, digestive organs, liver, spleen and kidney of rainbow trout killed by a phenol solution, whereas it was not detected in the digestive organs, liver, spleen and kidney of animals kept in the solution for 5 hours after death by suffocation. Thus, it was concluded that this method could be used as one of the methods for post-mortem identification of the pollutant in fish killed by water pollution. (Authors)

11363. Ishiwata, Naonori. 1968. ECOLOGICAL STUDIES ON THE FEEDING OF FISHES—V. SIZE OF FISH AND SATIATION AMOUNT. Bull. Jap. Soc. sci. Fish., 34(9): 781-784.

The satiation amount is standardized by the method described in previous reports; and the relationship between body weight and satiation amount is examined. As body weight increases the satiation amount increases proportionately. However, with increase in body weight, the "satiation ratio" (satiation amount/body weight) declines. Further, the stomach weight is proportionate to the body weight and the ratio (stomach weight/body weight) declines as the body weight increases. This phenomenon is due to the fact that the lighter fishes have a larger (stomach weight/body weight) ratio. In short, smaller fishes have larger stomachs for their size and thus a larger satiation ratio. (Auth.)

11364. Ishiwata, Naonori. 1968. ECOLOGICAL STUDIES ON THE FEEDING OF FISHES—VI. EXTERNAL FACTORS AFFECTING SATIATION AMOUNT. Bull. Jap. Soc. sci. Fish., 34(9): 785-791.

The satiation amount is standardized by the method described in previous reports. The influence of the kind of food on the satiation amount is examined. The satiation amount of a school of fish varies with the kind of food given. The satiation amount with one kind of food can be increased by feeding with more suitable food. In this study, it was found that a highly preferred food has a high satiation amount. (Auth.)

11365. Yamaguchi, Katsumi, Kanehisa Hashimoto, and Fumio Matsuura. 1968. STUDIES ON A BLUE-GREEN SERUM PIGMENT OF EEL—IV. SEASONAL VARIATION OF CONCENTRATION OF PIGMENT IN SERUM. Bull. Jap. Soc. sci. Fish., 34(9): 826-835.

Eel serum was examined monthly for the blue-green chromoprotein concentration throughout a year. The concentration was neither sex- nor growth-dependent. A seasonal variation of the concentration was found for both cultured and wild eels: the concentration was highest in July and August, 3-5 times as much as that in winter. Seasonal variation was clearer in the case of the cultured eel, roughly consistent with the amount of foodstuff given. With the catadromous eels,

a complete disappearance of the chromoprotein was confirmed. Based on these results, the physiological role of the chromoprotein is discussed. (Authors)

11366. Nakajima, Kenji, and Syuzo Egusa. 1968. STUDIES ON A NEW TRYPANORHYNCHAN LARVA, Callotetrarhynchus sp., PARASITIC ON CULTURED YELLOWTAIL—I. ON THE DISTRIBUTION, MORPHOLOGY AND CLASSIFICATION. Bull. Jap. Soc. sci. Fish., 34(9): 792-806.

Numerous bladder worms were found in the abdominal cavities of emaciated cultured yellowtails in the early spring of 1967 at a fish farm on the west coast of the island of Shikoku. The number of worms per fish varied from 6 to over 20, and the emaciation of the fish was attributed to this parasite. A subsequent survey revealed that not only cultured but also natural yellowtails along the whole stretch of the aforementioned coast mostly harbored the same parasite at any season. This parasite, however, has not yet been noticed at any fish farms in the other regions. Most of the blastocysts obtained were tadpole-shaped and ranged in body length from 5.8-28.0 mm, but part of them had the shape of an egg (6.5-9.4 mm) or the shape of a nematode (8.7-21.2 mm). Unencysted nematode-shaped blastocysts were occasionally noticed, particularly around the stomach of the fish. Unexpectedly, a few specimens in which the embryo had partially emerged from the cyst were discovered in the abdominal cavity of a fish. It was observed that in some of the egg-shaped or tadpole-shaped blastocysts examined an embryo had already been formed in the receptaculm of the blastocyst. The rate of occurrence of blastocysts with embryo varied from 21.4-77.5%, depending on the group of sample fish. Morphological observations were carried out on the 185 blastocysts obtained from 5 cultured and 1 natural yellowtails, and on the 136 embryos collected from the blastocysts. The dimensions and proportions of the parts, or organs of the embryos were measured on fixed specimens. Observations and measurements of the tentacle hooks were made on live embryos obtained from cultured yellowtails. On the basis of these observations the present worm was classified as belonging to the genus Callotetrarhynchus. It resembles, in the arrangement of hooks, three species of the genus; C. speciosum Linton, C. gracillimum Pintner, C. lepidum Chandler, and also Tentacularia pseudodera Shuler, but it is definitely different from any of them in the size and proportions of the body parts, and some morphological characteristics of the embryos. This strongly suggests the possibility that the present worm is a new species. (Authors)

11367. Hayashi, Seiichi, and Tsuneyuki Saito. 1968. BIOCHEMICAL STUDIES ON THE SKIN OF FISH—I. ACID-SOLUBLE NUCLEOTIDES IN THE DERMIS OF SOME FISHES. Bull. Jap. Soc. sci. Fish., 34(9): 816-825.

Fish skin has a peculiar character both in its structure and chemical components. Little is known about the relations between the physiological functions and the chemical constituents. On the other hand, many kinds of nucleotides have been found recently as the metabolic intermediates of some biologically important materials. Therefore, we have studied the occurrence of the nucleotides and their related compounds in the skin of some fishes so as to discover their relations to their biochemical aspects. The acid-soluble nucleotides and related compounds in the dermis of fishes were analyzed by anion-exchange chromatography (Dowex 1 x 8 100-200 mesh formate type). Carp, rainbow trout and salmon were used in these experiments. Among the nucleotides, nucleosides and bases studied, hypoxanthine was found in the richest amount. The hypoxanthine content, in all the identified compounds (expressed as μ moles/g fresh weight) was 47% (carp), 71% (rainbow trout), 88% (salmon male) and 65% (salmon female), respectively. Small amounts of uridylic acid, cytidylic acid and inosinic acid were also identified. In addition to these compounds, pteridine was identified in the dermis of rainbow trout. (Authors)

11368. Tiemeier, O. W., C. W. Deyoe, and S. Wearden. 1965. EFFECTS ON GROWTH OF FINGERLING CHANNEL CATFISH OF DIETS CONTAINING TWO ENERGY AND TWO PROTEIN LEVELS. Kansas Acad. of Science, 68(1): 180-186.

11369. Ooshiro, Zentaro. 1968. STUDIES ON PROTEINASE IN THE PYLORIC CAECA OF FISHES—I. ISOLATION AND PURIFICATION OF PROTEINASE FROM PYLORIC CAECA OF MACKEREL. Bull. Jap. Soc. sci. Fish., 34(9): 847-852.

Crude extract was obtained by homogenizing mackerel pyloric caeca with water, followed by filtration of the homogenate through Celite. By precipitating the extract with ammonium sulfate under the saturation degree from 0.3 to 0.7, the proteinase fraction was isolated from the extract. The fractionation of this precipitate by chromatography on a DEAE-cellulose column caused it to be separated into six enzyme fractions, with only one fraction having high activity: the specific fraction was further purified by gel filtration with Sephadex G-200. By this purification, the removal of two sorts of contaminating proteins from the proteinase fraction was accomplished. Concerning structure and molecular size, the enzyme preparation seemed to be almost homogeneous. (Auth.)

11370. Otte, Elmar. (Institut für Fischkunde der Tierärztichen Hochschule Wien, Austria). 1966. SEROLOGICAL AFFINITY REACTIONS OF FISH MUSCLE EXTRACTS. (Serologische Verwandtschaftsreaktionen von Fischmuskelextrakten). Zeitschrift für Fischerei und deren Hilfswissenschaften, 14(1/2): 123-128.

Having used agar precipitation, the author indicates that in Perciformes, Clupeiformes, Cypriniformes, and Anguilliformes there are no significant serological affinity reactions, whereas distinct affinity reactions occur among the families concerned. There is little possibility for delimiting the species within the families. The established antigen differences must be considered for a forensic detection of fish protein. (Auth. summ.)

11371. Pénzes, Bethen, and Istvan Tölg. (Zoologischer und Botanischer Garten, Budapest, Hungary). 1966. AQUARIUM STUDY OF THE PLANT CONSUMPTION OF THE GRASS CARP (Ctenopharyngodon idella Cuv. et Val.). Aquaristische Untersuchung des Pflanzenverbrauches des Graskarpfen (Ctenopharyngodon idella Cuv. et Val.). Zeitschrift für Fischerei und deren Hilfswissenschaften, 14(1/2): 131-136.

Beginning with the 1963 release in Hungary, the authors conducted a census of juveniles of the grass carp Ctenopharyngodon idella. It seems, after 3 years of continuous study, that establishment of the fish is possible. The plant consumption of C. idella and its advantageous features were examined. During the research the fishes were fed on 22 species of aquatic and landplants (alfalfa, lettuce), and their weight increased to 440-800 g. The plants are tabulated according to the preference of the carp. (Authors summ.)

11372. Szakolczai, Joseph and Kalman Molnar. (Veterinärmedizinischen Zentralinstitut, Budapest, Hungary). 1966. VETERINARY-MEDICAL INVESTIGATIONS ON THE PLANT-EATING FISH SPECIES ACCLIMATIZED IN HUNGARY. (Veterinärmedizinische Untersuchungen an den in Ungarn eingebürgerten pflanzenfressenden Fischarten). Zeitschrift für Fischerei und deren Hilfswissenschaften, 14(1/2): 139-150.

Vegetarian fish species introduced into Hungary were examined for their parasite fauna, bacterial flora of organs and digestive tract, quantitative and percentage serum protein content, and diseases contracted in this country. Of the four imported fish species (Ctenopharyngodon idella, Mylopharyngodon piceus, Hypophthalmichthys molitrix and Aristichthys nobilis), a total of 572 individuals were examined. Fishes imported from the USSR were, at the time of their introduction, free of parasites, whereas those imported from China have introduced several new parasite species. Later on, these parasites also invaded the fishes introduced from the USSR. Irrespective of their origin, vegetarian fishes became infected by several species of domestic fish parasites. Bacteriological tests of the organs were negative. Besides certain water bacteria (Achromobacter, Pseudomonas, etc.), the organism Aeromonas punctata was isolated most frequently; from 58.9 percent of the fishes examined. The average values of serum

protein content were total protein 4.82 percent; fractions: albumin 30.5 percent and α_1, α_2, β_1, β_2, and γ globulin were 14.4, 17.7, 12.4, 20.8 and 4.2 percent respectively. Among the vegetarian fish species, both parasitic diseases (chilodonellasis, diplostomosis, tetracotylosis) and dropsy have caused great losses. (Authors' summ.)

11373. Steffens, Werner, and Heinz Karst. (Institut für Binnenfischerei der Deutschen Akademie der Landwirtschaftswissenschaften zu Berlin, Germany). 1965. CHEMICAL COMPOSITION AND VITAMIN A CONTENT OF THE EGGS AND FRY OF RAINBOW TROUT (Salmo gairdneri RICH.). Chemische Zusammensetzung und Vitamin-A-Gehalt von Eiern und Brut der Regenbogenforelle (Salmo gairdneri RICH.). Zeitschrift für Fischerei und deren Hilfswissenschaften, 13(3/4): 163-168.

Beginning with fertilization until four weeks after hatching, the eggs and fry of rainbow trout were investigated at weekly intervals as to their content of water, crude fat, crude protein, crude ash, and vitamin A. After fertilization the water content rises considerably; after hatching a further increase follows. The content of crude fat as well as the content of crude protein and crude ash remains largely constant during embryonic development. After hatching, the fat content in the fresh and dry matter quickly decreases. The vitamin A values remain generally constant during embryonic development; yet after hatching there is a clear decline. The percentage of vitamin A_2 of the total vitamin A content is higher than that of vitamin A_1. (Authors' summ.)

11374. Nehring, Dietwart. (Institut für Binnenfischerei der Deutschen Akademie der Landwirtschaftswissenschaften zu Berlin, Germany). 1965. THE UTILIZATION OF DIFFERENT KINDS OF GRAINS AND LEGUMES BY CARP. (Die Ausnutzung verschiedener Getreidearten und Hülsenfrüchte durch Karpfen). Zeitschrift für Fischerei und deren Hilfswissenschaften, 13(3/4): 181-189.

The digestibility by carp of several diets was proved by the chromium oxide indicator test. The following digestive coefficients were obtained for the organic matter (crude protein): maize 62.2 (66.4), soy bean 62.9 (80.7), summer wheat 76.9 (82.7), summer barley 64.2 (69.0), peas 67.7 (78.6), oat 52.7 (64.3), yellow sweet lupine 41.5 (85.4), and winter rye 73.7 (62.5). These values are compared with previous results and also with the digestive coefficients of ruminants, pigs and rabbits. The suitability of the tested seed as a diet in pond farms is discussed. (Auth. summ.)

11375. Nehring, Dietwart. (Institut für Binnenfischerei der Deutschen Akademie der Landwirtschaftswissenschaften zu Berlin, Germany). 1965. INVESTIGATIONS OF THE NITROGEN CYCLE UNDER SPECIAL CONSIDERATION OF AN N-FERTILIZING FOR INCREASING PRODUCTION IN CARP PONDS. (Untersuchungen zum Stickstoffkreislauf unter besonderer Berücksichtigung einer N-Düngung zur Produktionssteigerung in Karpfenteichen). Zeitschrift für Fischerei und deren Hilfswissenschaften, 13(3/4): 191-215.

Tests of nitrogen metabolism showed that in carp ponds an intensive nitrogen exchange took place. The concentration of the different nitrogen compounds depends on vegetation rhythm. In addition, it seems that there is an intensive interaction between the water and the bottom of the pond, which, however, cannot be demonstrated clearly by chemical analysis. It was observed by investigations of the nitrogen balance that in general more nitrogen is added than is taken up. This becomes especially apparent in ponds fertilized with nitrogen. The nitrogen either is subjected to denitrification or is deposited as organic matter in the sediment. Ammonium nitrogen, added by fertilization, in a very short time is chemically converted or fixed by adsorption and therefore cannot be traced in the water. In 1963, by combined nitrogen-phosphate-fertilization, the yield was increased about 50% compared with unfertilized carp ponds. Pure nitrogen fertilization in 1964 brought in comparison with unfertilized ponds, only a 13% increase in yield; pure phosphate fertilization and combined phosphate-nitrogen-fertilization --- an increase of 17%. In that year, probably an organic fertilization of composting detritus covered the mineral fertilization. (Auth. summ.)

11376. Tanaka, Hikaru. 1967. ON THE CHANGE OF COMPOSITION OF AQUATIC INSECTS RESULTING FROM DIFFERENCE IN MESH SIZE OF STREAM BOTTOM-SAMPLERS. Bull. Freshwater Fish. Res. Lab., 17(1): 1-6.

Bagnets of bottom-samplers used to collect stream dwelling insects are not always the same in mesh size, and knowledge is lacking concerning change of samples resulting from difference in mesh size. The present study was made to gain information about this. Collection of aquatic insects was made in the upper reaches of the Kinu-gawa River from 1961 to 1963, by means of a Surber type bottom-sampler with double bagnets, which were made of bolting cloth of 23 meshes to the inch (inner-net) and 39 meshes to the inch (outer-net). In each of 56 collections, the reduction ratio $\left[(1-B/A) \times 100\right]$ was calculated as to the abundance of insects, as well as the number of species; B representing samples of the inner-net, and A, the combined ones of the inner- and outer-nets, which were regarded as the samples of a 39 meshes-per-inch bagnet used singly. Frequency distributions of the ratio are shown. Marked variation and high average value were revealed in the distribution of the number of individuals in each of the species; a similar tendency also was recognized in the total number of individuals and the total wet weight of small-sized species, such as Baetis sp. and Chironomidae (sp.). The distribution of the total wet weight of insects was largely biased toward low value; such tendency also was recognized in the total wet weight of species other than the small-sized insects, as well as the number of species. Checking of the body-length compositions of specimens gathered from the inner- and outer-nets showed that the reductions were caused mainly by selectivity of the net and seasonal changes in the populations of the different species. The insects passed through the outer bagnet appeared to be negligible in weight, though abundant in number. Suggestions are made for such collection on the basis of the results. (Auth.)

11377. Singh, Ravindra Pratap, and Takeshi Nose. (Dept. of Fisheries, Faculty of Agriculture, Univ. of Tokyo, Japan). 1967. DIGESTIBILITY OF CARBOHYDRATES IN YOUNG RAINBOW TROUT. Bull. Freshwater Fish. Res. Lab., 17(1): 21-24.

Carbohydrate digestibility was measured in young rainbow trout using the indicator method with reference to the concentration of carbohydrate in the diet. Glucose, sucrose, and lactose were easily digested and absorbed, and their digestibility remained nearly constant regardless of the level in the diet. Dextrin and potato α-starch were far inferior to the above-mentioned sugars in their digestibility, the values being 77% and 69%, respectively, at 20% carbohydrate level in the diet, and their digestibility had a negative correlation to the concentration of starch in the diet. (Authors)

11378. Shimma, Yaichiro, and Hisako Shimma. 1967. EFFECT OF DIETARY C_2-C_{14} EVEN NUMBER SATURATED FATTY ACIDS ON GROWTH AND FATTY ACID COMPOSITION OF RAINBOW TROUT. Bull. Freshwater Fish. Res. Lab., 17(1): 27-28.

Although a large amount of marine fish oil has been used by fish farmers as supplemental lipids to commercial feed, knowledge is scant concerning free fatty acids. This study was designed to determine the effect of dietary, short-chain, saturated, fatty acids on the growth and fatty acid composition of rainbow trout, Salmo irideus, compared with commercial feed oil and the dark oil of rice bran. Fish were fed a commercial combined feed supplemented with 8% (first experiment), or 2% (second experiment) lipids in experimental aquaria (45x23x30 cm). After three weeks of feeding, the fish were beheaded and the lipids were extracted with a methanol-chloroform solution from the liver, other viscera, and carcasses, respectively. The cholesterol content of the organs, and the fatty acid composition of the feed, feces and fish organs were determined. Experiment 1 — In the groups of myristic (II), lauric (III), capric (IV), caproic (VI), and acetic (VIII) acids growth of the fish was inferior to control groups (I and I'), worsening in proportion to the decrease in the carbon number of the acids. In

particular, the fish refused the feed with caproic acid. Lipid content of the fish ranged as follows: carcasses 2.6 - 4.9%; liver 2.6 - 4.1%; viscera 11 - 22%. Cholesterol was found to be 151 - 250 mg% in carcasses, 340 - 733 mg% in liver, and 222 - 500 mg% in viscera. The relationship between the lipid content and the growth rate of the fish is shown. Fatty acids having chains longer than capric acid were found distinctly to be deposited in the viscera and carcasses, and the fatty acids of these parts showed similar composition by GLC. The fatty acid composition of the liver differed from that of the viscera or carcasses; it bore a slight influence of the supplemented lipids, with a large variation of docosahexenoic acid content among the test groups. The feces of the fish contained more saturated and less polyunsaturated fatty acids than did the feed lipids. Experiment 2 — Supplementation of 2% fatty acids had no effect on the feeding behavior of fish. Myristic (II) and butyric (VII) acid groups, however, grew better, while caproic (VI) and acetic (VIII) acid groups showed inferior food efficiency to the others. Lipid content of the liver and viscera was 3.3 - 4.9%, and 9.3 - 19.8%, respectively. Cholesterol was 110 - 360 mg% in the liver, and 302 - 403 mg% in the viscera. Except for a small amount of deposited lipids in groups II and III, and a large variation of the docosahexenoic acid content among some groups, the fatty acid composition of test groups had no distinguishable difference from control groups (I and I'). No satisfactory explanation could be found for the intergroup variation of polyunsaturated acid. The deposition of fatty acids is discussed. (Authors)

11379. Kawatsu, Hiroshi, Keiji Ogimoto and Koji Suto. 1967. IMMUNOELECTROPHORETIC ANALYSIS OF CROSS-REACTIVITY OF RAINBOW TROUT SERUM. Bull. Freshwater Fish. Res. Lab., 17(1): 41-45.

Immunoelectrophoretic analysis (IEA) was applied to examine the cross-reactivity of the sera of three salmonoid fishes. Rabbit antiserum against rainbow trout serum (Anti-RTS serum) was prepared by three injections of 0.5 ml. rainbow trout serum, which had been previously emulsified with an equal volume of incomplete Freund's adjuvant, and one intravenous injection of 0.5 ml. serum as a booster. The reactions with Anti-RTS serum were examined against the sera of rainbow trout, brook trout and kokanee (Himemasu). In a capillary tube precipitation test, positive reaction of Anti-RTS serum was recognized at a dilution of 1 : 128 against rainbow trout serum, and 1 : 64 against both brook trout and kokanee serum. IEA patterns obtained with the sera of the three fishes showed a trend similar to that in the precipitation test in capillary tubes. Rainbow trout serum yielded 12 detectable components , and both brook trout and kokanee, 9 components. Mobility of the serum components of brook trout was similar to that of the serum components of rainbow trout, and that of kokanee was dissimilar to that of rainbow trout. Accordingly, it can be hypothesized that the kokanee is phylogenetically more different from the rainbow trout than the brook trout. When the Anti-RTS serum was absorbed by the brook trout serum, 4 components remained in the IEA pattern against rainbow trout serum. These components corresponded to the components 1, 5, 6 or 7 and 8 or 9. Component 5 was the most clearly marked of these four components. (Authors)

11380. Honma, Yoshiharu, and Eimitsu Tamura. 1967. STUDIES ON JAPANESE CHARS OF THE GENUS Salvelinus — III. THE HYPOTHALAMO-HYPOPHYSIAL VASCULAR SYSTEM OF THE NIKKO-IWANA, Salvelinus leucomaenis pluvius, IN RELATION TO ITS NEUROSECRETORY SYSTEM. Bull Jap. Soc. Sci Fish., 33(4): 303-310.

The vascular supply to the hypothalamo-hypophysial region of the Japanese char, the Nikko-iwana, Salvelinus leucomaenis pluvius, was examined histologically after vascular injection with Chinese ink. In this species, there is neither a true hypophysial portal vessel system, which connects the hypothalamus with the pars distalis, nor a portal system-like structure between the neurohypophysis and the adenohypophysis. The branches of the anterior cerebral arteries from the internal carotid artery supply the blood to the hypothalamic region, and the branches from the posterior cerebral arteries, which direct anterolaterally, provide the blood for the hypophysial region. Two main hypophysial arterial systems are

detected, since the posterior cerebral artery divides itself into an anterior vascular plexus and posterior fine branches after passing through the pituitary stalk. The anterior vascular plexus forms the blood sinuses and projects into the region of the adenohypophysis, and the latter invades deeply into the neurohypophysial digits. CH- or AF-positive neurosecretory granules from the nucleus preopticus concentrate on the wall of the veins found in the digits of the pars nervosa. On the other hand, acid-fuchsin-positive neurosecretory axons from the nucleus lateralis tuberis are distributed chiefly around the vascular plexus located near the pars distalis. Accordingly, a possible role for this vascular plexus, which is analogous to that of the hypothalamic portal vessel system and the gonadotropic activity of the hypophysis, is intimated. (Authors)

11381. Oguri, Mikio, and Naoko Takada. 1967. SERUM CALCIUM AND MAGNESIUM LEVELS OF GOLDFISH, WITH SPECIAL REFERENCE TO THE GONADAL MATURATION. Bull. Jap. Soc. sci. Fish., 33(3): 161-166.

Using 294 goldfish at various stages of gonadal maturation, serum calcium, magnesium and the effect of estradiol on serum calcium and magnesium were investigated. Conspicuous elevation of the total calcium level was observed in the serum of goldfish injected with estradiol. Elevation of the total magnesium level was detected also in the serum of these fish. A relationship was observed between the total calcium level in the blood serum and ovarian maturation of the goldfish. Mature female goldfish showed hypercalcemia. On the contrary, no distinctive relationship was observed between the calcium level in the serum of male goldfish and testicular maturation. Total calcium in the serum of male goldfish was 3.17±0.12mEq/L on the average. Total serum magnesium of male and female goldfish was 1.63±0.12 and 1.50±0.07mEq/L on the average, respectively. (Authors)

11382. Yamanaka, Hideaki, Katsumi Yamaguchi, Kanehisa Hashimoto, and Fumio Matsuura. 1967. STARCH-GEL ELECTROPHORESIS OF FISH HEMOGLOBINS—III. SALMONOID FISHES. Bull. Jap. Soc. sci. Fish., 33(3): 195-203.

Starch-gel electrophoretic analysis was carried out on Hb's from 12 species of salmonoid fishes. The Hb patterns were independent of sex or of the place of catch. There was some dependence on age. On the whole, the salmonoid Hb's showed many more components (8-14), compared to other kinds of fish examined so far. In spite of some common features, the salmonid Hb patterns were all species-specific, allowing one to be distinguished from the other. Three species of Salvelinus, the brook trout, "amemasu", and Dolly Varden, showed fairly similar Hb patterns, while rainbow and brown trouts, both of the genus Salmo, showed patterns fairly different from each other. In Oncorhynchus, remarkable resemblance was noted in the Hb patterns between chum salmon and "himemasu" and between "sakuramasu" and "biwamasu", whereas the pink salmon Hb was somewhat unique. "Yamame" and "hommasu" had almost the same pattern as "sakuramasu". Hybrid individuals (F_1) between chum salmon and "himemasu" showed Hb patterns comparable to the parental ones or having one or two additional bands. (Authors)

11383. Iwai, Tamotsu, (Dept. of Fisheries, Faculty of Agriculture, Kyoto Univ., Maizuru, Japan). 1967. THE COMPARATIVE STUDY OF THE DIGESTIVE TRACT OF TELEOST LARVAE—II. CILIATED CELLS OF THE GUT EPITHELIUM IN POND SMELT LARVAE. Bull. Jap. Soc. sci. Fish., 33(12): 1116-1119.

In the larvae of pond smelt, ciliated cells are visible in the epithelium of the posterior gut. Food and faecal materials are carried posteriorly by the beating of cilia. In the 6-day larvae ciliated cells are fully bordered by cilia, but in the ciliated cells of 18-day larvae both cilia and microvilli are interlacing. The reduction of ciliated cells at late larval stage implies the transition in the epithelial border from the ciliated one to the striated one. (Auth.)

11384. Charles, James J. 1967. THE DEWEY LAKE (RESERVOIR) FISHERY DURING THE FIRST SEVENTEEN YEARS OF IMPOUNDMENT. Kentucky Dept. of Fish & Wildlife Resources, Fisheries Bull. No. 47. 63 p.

Fish population studies have been conducted at Dewey every summer since 1951 - 15 consecutive years of sampling. Wide fluctuation in the fish population has occurred from year to year, in response to various population manipulation efforts, not only in relative abundance and biomass, but in the size-class structure as well. Most of the research and management activities have been directed toward suppression of a single species: gizzard shad. Sport fishing quality between 1964 and 1966 was judged to have been both satisfactory and unsatisfactory depending upon the parameters used: the annual average catch rate ranged between 0.70 to 0.93 fish per man-hour, considered moderately good; fisherman success during the same 3-year period ranged from 34% to 43% successful anglers, considered rather poor. The lakebed at Dewey Lake was clear-cut prior to impoundment; consequently, to enhance the habitat for both the fish and the fisherman, 4 used automobile bodies were clumped at each of 50 sites in the lower half of the lake in 1963. An additional 250 used car bodies were placed at 25 of the better locations in 1965. Each site was marked by a numbered, wooden float cabled to the center body in the cluster. Attempting to thin out the gizzard shad and white crappie populations in Dewey Lake, the lake level in October, 1962 was lowered rapidly from 650 feet to 625 feet. Results of the rapid drawdown, evaluated by population sampling the following summer, were quite satisfactory. A second drawdown was accomplished in November, 1964, when the lake was lowered 25 feet in 5-foot decrements. The 5-stage drawdown did not achieve the desired results; in fact, gizzard shad were nearly as abundant the following year as they had been before the drawdown. Water quality determinations at three widely separated stations, made for the first time on a monthly, year-round basis in 1964 and 1965, documented physical and chemical characteristics well within expected ranges. Thermal stratification was typical and well defined during the warmer months. (Auth.)

11385. Jones, Albert R. 1968. CHANGES IN THE BASS POPULATION OF ELKHORN CREEK FOLLOWING THE ESTABLISHMENT OF A SIZE LIMIT. Kentucky Dept. of Fish & Wildlife Resources, Fisheries Bull. No. 45. 34 p.

Fish population studies conducted on the Main Stream and North Fork of Elkhorn Creek each year in the fall, from 1961 through 1965 revealed an increase in the black bass population (mainly smallmouth). The greatest increase was in the number of intermediate-sized bass; from 8.2 fish per acre in 1961 to 18.8 fish per acre in 1965. The number of harvestable-sized black bass increased in number from 2.1 fish per acre in 1961 to 5.7 fish per acre in 1965 while their mean weight decreased from approximately 1 pound to 0.5 pound. The fish population in the South Fork is affected by municipal sewage treatment effluent and has been erratic in both number of fish per acre and species composition throughout this study. There has been a continuous decrease in the fish population since 1962 except at the lowermost section of the stream, the farthest downstream from pollution. Here the intermediate-sized smallmouth bass population increased from 4 fish per acre in the fall of 1962 to 6 fish per acre in 1965, but the harvestable-sized smallmouth bass population decreased. The fishing pressure on the Main Creek and North Fork decreased from 21, 950 fisherman hours in 1960 to 19, 131 fisherman hours in 1965. Fishing pressure on South Elkhorn, during 1960, was 846 fisherman hours. The average number of fish harvested per hour from the North Fork and Main Stream of Elkhorn Creek decreased from 0.86 in 1960 to 0.60 in 1965. The rate of harvest from South Elkhorn, in 1960, was 0.87 fish per hour. Water quality studies at Station 2A, which is located closest to the source of pollution, generally revealed a lower dissolved oxygen concentration than at stations downstream. In 1962, the maximum concentration of oxygen, at Station 2A, was 2.5 ppm. Alkyl benzene sulphonate was considerably higher at Station 2A, where a maximum of 3.80 ppm was recorded on June 30, 1964. At Station 2A concentrations of ammonia nitrogen exceeded 3.50 ppm in 11 of 13 samples taken during 1962 and 1963. The total phosphates, at Station 2A, ranged from 14.80 ppm

(recorded July 2, 1963) to less than 0.01 ppm in July of 1965 while at stations above the effluent total phosphates failed to exceed 3.20 ppm. The highest concentration of total alkalinity (255 ppm) was found at Station 3A in 1962. Each year the mean concentration of alkalinity was greatest at Station 2A. The pH varied little. (Auth.)

11386. Hofbauer, J. (Zoologischen Institut der Universität Würzburg, Germany). 1965. THE COMPOSITION OF SHOALS OF FRY AND JUVENILE FISH IN THE MAIN RIVER ENLARGED FOR SHIP PASSAGE. (Die Zusammensetzung der Brut- und Jungfischschwärme in dem zu einer Schiffahrtsstraße ausgebauten Main). Zeitschrift für Fischerei und deren Hilfswissenschaften, 13(3/4): 217-234.

11387. Jaszfalusi, Lajos, and Janos Páskándy. (Lehrstuhl für Tierzucht der Agrarwissenschaftlichen Universität in Gödöllö und Agronomie des Ungarischen Landesverbandes der Angler, Budapest, Hungary). 1965. STUDIES ON GROWTH VARIATION IN THE POND CARP. CHANGES IN THE GROWTH RATE OF THE POND CARP IN THE COURSE OF ITS INDIVIDUAL DEVELOPMENT. (A. Untersuchungen über die Wachstumsstreuung des Teichkarpfens. B. Änderungen im Wachstumstempo des Teichkarpfens im Laufe seiner individuellen Entwicklung). Zeitschrift für Fischerei und deren Hilfswissenschaften, 13(3/4): 235-258.

This article deals with the problem of "fast-growing" among pond carps during their initial growing period, beginning with the hatching of the fry. In controlled tests, the influence on differences in length and weight were examined in the sac period and during the first and second summer. In addition, dependence on environmental conditions, the kind of fertilization (homosperm and heterosperm fertilization), and the sex ratio of larger populations was studied. On the whole, environmental factors are of greater importance for different growth than genetic factors. Heterosperm fertilization (spawning in the stock) is more favorable for direct production than spawning by pairs. Also, it is recommended that selection of the fast-growing carp takes place in the first year-class. The author indicates a gradually extensive equalization of different growth and emphasizes the important role played by the faster growing females in the stock. (Authors summ.)

11388. Zivkovitch, Vera, and Dragica Kacanski. (Institut für medizinische Forschung in Beograd und dem Biologischen Institut in Sarajevo, Yugoslavia). 1965. THE PART OF BLACKFLIES (Diptera, Simuliidae) IN THE FEEDING OF FISH. (Der Anteil der Kriebelmücken (Diptera, Simuliidae) in der Ernährung der Fische). Zeitschrift für Fischerei und deren Hilfswissenschaften, 13(3/4): 261.

11389. Busnita, Th., and Gh. Brezeanu. (Institutul de Biologie "Traian Savulescu" Academia Republicii Populare Române Comisia de Hidrologie, Rumania). 1965. HYDROCHEMICAL AND HYDROBIOLOGICAL CONDITIONS IN FISH PONDS WHICH ARE FED WITH RIVER WATER, AS WELL AS THEIR PRODUCTIVITY. (Hydrochemische und hydrobiologische Bedingungen in Fischteichen, die mit Flußwasser gespeist werden sowie deren Produktivität). Zeitschrift für Fischerei und deren Hilfswissenschaften, 13(3/4): 269-282.

At present, pisciculture deals with two important problems: increase of the catch per unit and decrease of the cost. Tests in fish ponds receiving their water by pumping from streams show that by regulating the flow and the water-level, by green and chemical fertilization and by natural and supplemental food during the entire vegetative period, good results can be obtained. Furthermore, the tests showed that of great importance are: early irrigation of the ponds in March; stopping the flow in March-June; from June to September keeping the water at the same level (flow 3-5 liter/sec/ha); green fertilization and fertilization with superphosphate, supporting the development of algae, chironomids and oligochaetes. A natural yield of 550-900 carp per hectare at low cost is likely. Increased yields of carp with supplemental food are only profitable as long as they are not more expensive than food of the same nutritive value. (Authors summ.)

11390. Kolarov, P. (Institut für Fischerei Warna - Bulgarien, Bulgaria). 1965. THE TOXICITY OF Prymnesium parvum CARTER UNDER CONDITIONS OF LOW TEMPERATURE. (Die Toxizität des Prymnesium parvum CARTER unter den Bedingungen niedriger Temperaturen). Zeitschrift für Fischerei und deren Hilfswissenschaften, 13(3/4): 285.

11391. Libosvarsky, J., and A. Lelek. (Institut für Wirbeltierforschung der Tschechoslowakischen Akademie der Wissenschaften, Brno, Czechoslovakia). 1965. ON SPECIES SELECTIVITY IN ELECTRO-FISHING. (Über die Artselektivität beim elektrischen Fischfang). Zeitschrift für Fischerei und deren Hilfswissenschaften, 13(3/4): 291-301.

Based upon the fishing yield obtained by triplicate and partially-duplicate D. C. electro-fishing in a total of 45 reaches, the efficiency and catchability of different fish species were investigated. In subsequent landings the weight of the catches dropped more rapidly than the number of specimens. Some species, occurring only seldom in the reaches, were taken even in the subsequent catches. Without regard to their abundance, different species were taken in the first catch. Most of the species and most of the reaches showed a decline in the number of specimens caught. Here, to a certain degree, the catchability was uniform. On the other hand, some species often were excepted from this decline (e. g. stone loach and bullhead). It was found that the different catchability of some species may be ascribed to the specific composition of the stock. (Authors summ.)

11392. Schlüter, Marlis. (Institut für Fischereiwesen der Humboldt-Universität zu Berlin, Berlin-Friedrichshagen, Germany). 1965. ON THE EFFECT OF SOME FUNGICIDES AND HERBICIDES AGAINST FRESHWATER ALGAE UNDER LABORATORY CONDITIONS. (Über die Wirkung einiger Fungizide und Herbizide gegenüber Süßwasseralgen unter Laboratoriumsbedingungen). Zeitschrift für Fischerei und deren Hilfswissenschaften, 13(3/4): 303-313.

The algicidal properties of two fungicides, copper sulphate and Spritz-Cural 45, and of the three herbicides, W6658, Telvar Cela, and Streu-Hormin were examined. As test algae served Chara hispida and algal cultures of Anabaena flosaquae, Oscillatoria agardhii, Nitzschia palea, Ankistrodesmus falcatus, and Scenedesmus quadricauda. The effect of the tested concentrations on Chara hispida is shown. The effective concentrations of Telvar Cela and W 6658 to Chara hispida and the other tested freshwater algae lie in a similar range. Spritz-Cupral 45 proved to be more toxic against Chara hispida than against Chlorococales. The applied concentrations of copper sulphate and Streu-Hormin were ineffective against all examined Chlorophyta. Only Telvar Cela was equally inimical to algae and higher submersed plants; the other herbicides are less effective against higher submersed plants than against algae. (Auth. summ.)

11393. Ghittino, P. (Istituto Zooprofilattico Sperimentale del Piemonte e Della Liguria Centro per lo Studio Delle Malattie Dei Pesci, Torino, Italy). 1968. SYSTEMIC CONTROL OF HEXAMITIASIS IN TROUT FINGERLINGS. Riv. It. Piscic. Ittiopat. 3(1): 8-10.

The author reports the clinical and etiological characteristics basing on which Hexamitiasis can be diagnosed in hatchery young trout. The etiological agent of the disease (Hexamita salmonis) can be discovered through a microscopic examination of the intestinal contents of suspected fishes. The author affirms that "Emtrysidina Farmitalia", a product containing 100 g of Dimetridazole and 28. 5 g of Amminosidine/Kg, is effective in the control of the disease if included at 1. 5 percent in self-sustaining dry diets. The treatment is well tolerated by fish, and therefore it can be suggested in the systemic eradication of Hexamitiasis in trout hatcheries. (Auth. summ.)

11394. Mather, Frank J. III. (Woods Hole Oceanographic Institution, Mass.). 1969. LONG DISTANCE MIGRATIONS OF TUNAS AND MARLINS. Underwater Naturalist, 6(1): 6-14.

11395. Strickland, K. L., and J. T. Carbery. (Veterinary Res. Lab., Abbotstown, Castleknock Co. Dublin, Ireland). 1968. ULCERATIVE DERMAL NECROSIS (U. D. N.) OF SALMON IN IRELAND. Rivista Italiana di Piscicoltura e Ittiopatologia, 3(1): 12-14.

A disease of salmon, designated ulcerative dermal necrosis (U. D. N.) which appeared in Ireland in 1964 is described. An account is given of its spread throughout the country in subsequent years. Details of symptoms and lesions and of investigation into the aetiology of the condition are briefly outlined. (Authors summ.)

11396. Ghittino, P. (Istituto Zooprofilattico Sperimentale del Piemonte e Della Liguria Centro per lo Studio delle Malattie Dei Pesci, Torino, Italy). 1968. A SERIOUS ENZOOTIC CASE OF VIRAL HEMORRHAGIC SEPTICEMIA IN HATCHERY BROWN TROUT (Salmo trutta). Rivista Italiana di Piscicoltura e Ittiopatologia, 3(1): 17-19.

The author reports a case of Viral Hemorrhagic Septicemia (VHS) seriously affecting a lot of hatchery brown-trout yearlings (Salmo trutta), kept in an Italian trout farm after importation. The disease showed all the characteristics (clinical symptoms, macro- and micro-scopic pathological lesions) that have been long familiar in hatchery rainbow trout (Salmo gairdneri) affected with VHS. The author reproduced the disease in healthy rainbow trout yearlings, using ground organs taken from brown trout affected with the disease. The bacteria-free pathological material, diluted in salt solution, was intraperitoneally inoculated or spread on the gill of experimental fish. VHS, which was so far considered as an exclusive disease of rainbow trout, can also affect brown trout kept in practical hatchery conditions. Brown trout can be no longer considered as resistant toVHS. (Auth. summ.)

11397. Ghittino, P. (Istituto Zooprofilattico Sperimentale del Piemonte e Della Liguria Centro per lo Studio Delle Malattie Dei Pesci, Torino, Italy). 1967. VIRAL HEMORRHAGIC SEPTICEMIA (VHS) IN HATCHERY RAINBOW TROUT. Rivista Italiana di Piscicoltura e Ittiopatologia, 2(4): 90-101.

The author reviews the present knowledge on Viral Hemorrhagic Septicemia (VHS) of hatchery rainbow trout (Salmo gairdneri). The disease, which has been long known in Europe and variously named, was so called in agreement with decisions reached during international meetings on Fish Disease (Turin, 1962; New York, 1964; Munich, 1965). VHS is discussed concerning its diagnosis (including clinical symptoms and macro- and micro-scopic lesions), etiology, pathogenesis, source and reservoir of infection, mode of natural and artificial transmission, incubation period, susceptibility and resistance, geographical distribution and occurrence, phophylactic and therapeutic controls. Synthetically, VHS is to be considered as the most dangerous infectious disease which can affect hatchery rainbow trout. One is powerless against it. The disease is caused by a virus, that can be cultivated in vitro on trout-cells monolayers and whose morphological characteristics are similar to the ones of vesicular stomatitis virus; it causes necrotic and hemorrhagic changes in several tissues of trout (muscles, heart, liver, kidney, etc.). The author ascribes particular importance to the characteristics basing on which VHS can be identified, i. e.: infectivity for rainbow trout only; incubation period of about 7-15 days; outbreak often connected with an import of trout from other hatcheries and after transportations; seasonal occurrence (end of winter - beginning of spring) and in water at temperatures lower than 8°C.; appearing of trout with dark skin-colour, exophthalmus, gill anemia, and especially with hemorrhagic changes in eyes, gills, muscles, air bladder, perivisceral adipose tissue; onset of trout slowly spiralling in the water at the end of the pond, with retracted abdominal wall but with normal gill colour; no evidence of germs in bacteriological cultures, particularly for bacteria inducing septicemical diseases with similar pathoanatomical characteristics (Furunculosis, f. i.); absolute failure of per os and environmental treatments. Concluding, the author considers the direct prophylaxis as the one means which can be suggested today against VHS. The method should absolutely exclude any hypothetical infection-source in susceptible fishes. He briefly discusses also the methods of international prophylaxis that should be adopted without delay. (Auth.)

11398. Wells, LaRue. (Bur. of Comm. Fish. Biol. Lab., Ann Arbor, Michigan). 1968. SEASONAL DEPTH DISTRIBUTION OF FISH IN SOUTHEASTERN LAKE MICHIGAN. U. S. Dept. of the Interior, Fish. Bull. 67(1): 1-15.

This study is based on systematic seasonal bottom trawling between 3 and 50 fathoms (5.5 and 91.5 m.) from February to November 1964 and supplementary information from other experimental fishing at additional depths and with other gear. The seasonal depth distribution of eight common species is described, and temperature relations are discussed. Catch records for less common species are mentioned briefly. Alewives are mostly pelagic during their first 2 years, but many young of the year are on the bottom in the fall, and yearlings occasionally descend to the bottom in substantial numbers in the spring and fall. Adults are mostly on the bottom in the winter and spring, but a significant portion of the population may be at mid-levels in the summer and fall. Bloaters are in midwater during their first 2 years, but usually on the bottom thereafter. Young-of-the-year American smelt are in midwater except in the fall, yearlings are in midwater or on the bottom, and adults are mostly on the bottom. Alewives, bloaters, smelt, spottail shiners, trout-perch, and yellow perch on the bottom moved into shallower water in the spring and into deeper water in the fall, in response to temperature changes. Slimy sculpins abandoned inshore areas as water warmed in the spring. Fourhorn sculpins showed a slight movement shoreward in the spring, but changed their depth distribution little thereafter to the end of the trawling season. Alewives showed the greatest seasonal change in distribution. Large concentrations at 40 to perhaps 70 fathoms (73.2-128.0 m.) in mid-March had migrated to water of less than 15 fathoms (27.4 m.) by mid-April. They were in shallow water along shore or in rivers until early summer; then they began a postspawning movement back into deeper water which continued into the fall. Depth ranges in which greatest numbers of other common species occurred, considering all seasons as a whole, were as follows: bloater, 12 to 50 fathoms (21.9-91.5 m.); American smelt, 5 to 17 fathoms (9.1-31.1 m.); spottail shiners, 3 to 15 fathoms (5.5-27.4 m.); trout-perch, 5 to 17 fathoms (9.1-31.1 m.); yellow perch, 3 to 15 fathoms (5.5-27.4 m.); slimy sculpins, 15 to 40 fathoms (27.4-73.2 m.); fourhorn sculpins, 45 to 70 fathoms (82.2-128.0 m.). Water temperature ranges (°C.) in which the various species were most abundant in summer were: alewife, 8 to 22; bloater, 6 to 10; smelt, 6 to 14; spottail shiner 13 to at least 22; trout-perch, 10 to 16; yellow perch 11 to at least 22; slimy sculpin, 4 to 6; fourhorn sculpin, 4 to 4.5. Fluctuations in inshore water temperatures in the summer caused short-term changes in depth distribution. (Auth.)

11399. Trefethen, Parker S., and Doyle F. Sutherland. (Bur. of Comm. Fish. Biol. Lab., Seattle, Washington). 1968. PASSAGE OF ADULT CHINOOK SALMON THROUGH BROWNLEE RESERVOIR, 1960-62. U. S. Dept. of the Interior, Fish. Bull. 67(1): 35-45.

Adult chinook salmon (Oncorhynchus tshawytscha) were tagged and released in Brownlee Reservoir and upstream in the Snake River to determine if adults could pass through the reservoir and reach spawning grounds. Experiments with Petersen disk tags were performed by the Idaho Fish and Game Department in 1960-61 and by the Department and the Bureau of Commercial Fisheries in 1962. In addition, the Bureau marked salmon with sonic tags in 1961-62 to trace orientation and movement. Information was also obtained on the use of tributary streams for spawning and success of spawning. Fish marked with Petersen disk tags and released in the 92.5-km.-long reservoir reached their spawning area as successfully as those transported above the impoundment and released in the river. Fish released during periods of constantly high water temperature in 1961-62 suffered losses, which may have been caused by stress during tagging. Some salmon with sonic tags were initially disoriented when released in the reservoir; those released in the river above the impoundment quickly oriented to the flow and resumed migration upstream. Subpopulations of spring- and fall-run chinook salmon continued to use ancestral spawning areas in streams tributary to the impoundment after it was formed in 1958. No differences were noted between percentages of totally spent fall-run fish on the spawning grounds in the years before and after Brownlee Reservoir was filled. (Authors)

11400. Fast, Arlo W. 1968. ARTIFICIAL DESTRATIFICATION OF EL CAPITAN RESERVOIR BY AERATION. PART I - EFFECTS ON CHEMICAL AND PHYSICAL PARAMETERS. Resources Agency of Calif., Dept. of Fish and Game, Fish. Bull. 141, 95 p.

Most lower elevation California lakes experience one yearly cycle of stratification. Thermal stratification generally starts about March and extends through November, greatly influencing chemical and biological stratification. The metalimnion and hypolimnion of eutrophic lakes often are devoid of oxygen. Concomitant with the oxygen deficit is the build-up of anaerobic decomposition products and the exclusion of biota from the oxygen deficient zones. Artificial destratification by aeration reduces or eliminates thermal stratification. Oxygen is distributed to all depths and products of anaerobic decomposition are oxidized. Barriers to biotic distribution are minimal. The diffuse aeration system is probably the most effective for destratifying large lakes. Other methods are discussed. Artificial lake destratification increases the lakes' heat budget. The winter temperature regime is not affected by destratification. Summer surface temperatures during stratified and destratified periods are about equal. Bottom temperatures are greatly increased by destratification and may equal the surface temperatures. The coldest water temperature in a destratified lake may approach those found at the lake's surface during stratified periods. This increased heat content should benefit the fishery by increasing invertebrate forage production and decomposition of organic sediments. However, increased bottom temperatures may eliminate or preclude the establishment of a coldwater fishery. Two hypolimnion aeration systems are discussed. These systems aerate the bottom waters without causing the thermal destratification and enhance coldwater fisheries. Lake aeration is economically feasible. Evaporation and chemical treatment savings alone may more than pay for the aeration system. Improved drinking water quality and fishery habitats result from aeration. This report is the first of a series describing our El Capitan Reservoir destratification study. Subsequent reports will describe the effects of artificial destratification on the zoobenthos, phytoplankton and fishes. (Auth.)

11401. Hancock, Hunter M. 1969. CATFISH FISHERY INVESTIGATIONS. Kentucky Dept. of Fish and Wildlife Resources, State of Kentucky Project No. 4-27-R, 83 p.

Catfish investigations were conducted in the Kentucky portion of Kentucky Lake in 1967 and 1968. Age and growth analysis of the channel catfish indicated that they averaged 4.17, 8.03, 10.74, 13.06, 14.91, 16.15, 17.30, 18.71, and 19.46 inches in years one through nine respectively. Blue catfish attained average lengths of 4.30, 7.96, 11.48, 14.79, 18.34, 21.56, 24.55, 27.54, and 32.84 inches in years one through nine respectively. Length-weight relationships show that the channel catfish weighed approximately 0.33 pound at 10 inches, 1.18 pounds at 15 inches, 2.91 pounds at 20 inches, and 5.15 pounds at 24 inches. Blue catfish weighed 0.34 pound at 10 inches, 1.28 pounds at 15 inches, 3.24 pounds at 20 inches, and 6.68 pounds at 25 inches. Flathead catfish weighed 0.44 pound at 10 inches, 1.52 pounds at 15 inches, 3.69 pounds at 20 inches, 7.34 pounds at 25 inches, and 12.86 pounds at 30 inches. Preponderance of smaller-sized catfish and scarcity of commercial-sized catfish were evidenced by 99.5 percent composition of fish under 15 inches in length, and 0.5 percent composition of fish over 15 inches in length. (Auth. summ.)

11402. Miller, Robert Victor. (Bur. of Comm. Fish. Tropical Atlantic Biol. Lab., Miami, Fla.) 1969. CONTINENTAL MIGRATIONS OF FISHES. Underwater Naturalist, 6(1): 15.

11403. Nelson, Joseph S. (Dept. of Zoology, the Univ. of Alberta, Edmonton, Alberta, Canada). 1968. ECOLOGY OF THE SOUTHERNMOST SYMPATRIC POPULATION OF THE BROOK STICKLEBACK, Culaea inconstans, AND THE NINESPINE STICKLEBACK, Pungitius pungitius, IN CROOKED LAKE, INDIANA. Proc. Ind. Acad. Sci., 77: 185-192.

11404. Kennedy, Michael (Inland Fisheries Trust, Dublin, Eire). 1969. SPAWNING AND EARLY DEVELOPMENT OF THE DACE Leuciscus leuciscus (L.). J. Fish Biol. 1, 249-259.

In the spring of 1965, a study of the spawning of dace was carried out in tributaries of the Cork Blackwater at and near Kanturk, Co. Cork. Dace spawned on 28 March 1965 in a riffle in the River Dalua, where the bottom was stony and irregular and the depth was 25 to 40 cm. The ova were scattered among the stones, adhering to them and the sand and gravel around and under the stones. The eggs were 2.0 to 2.5 mm in diameter and were greyish and relatively opaque. Full-term larvae hatched after 29 to 31 days at a mean water temperature of 11°C. The newly hatched larvae were about 8.6 mm long, with pigmented eyes and well-developed melanophores. In normal larvae a swim-bladder was developed within 24 h. The yolk-sac was absorbed in a week to ten days, when the larvae were approximately 10 mm long. The dorsal and anal fins were complete when the postlarvae were 12 to 14 mm long and pelvic fins appeared when they were 15 mm long. Feeding began before the yolk-sac was fully absorbed. The first food in the wild is probably unicellular algae. Spawning in 1965 was probably delayed by very cold weather in early March. (Auth. summ.)

11405. Banks, J. W. (Dept. of Zoology, Univ. of Liverpool, Liverpool, England). 1969. A REVIEW OF THE LITERATURE ON THE UPSTREAM MIGRATION OF ADULT SALMONIDS. J. Fish Biol. 1, 85-136.

11406. Sinha, V. R. P. and H. Evans (Dept. of Zoology, Univ. of Liverpool, Liverpool, England). 1969. SALMON REARING IN MOUNTAIN TARNS. THE SCALES AND GROWTH OF THE FISH OF LLYNAU DYRNOGYDD, TEYRN AND CILAN. J. Fish Biol. 1, 285-294.

Salmon parr were reared in three small lakes. Samples of fish were taken and scales of fish examined for age and formation of growth rings. Salmon grew best in Cilan, where the water is much warmer and very rich in minerals. Normal sized salmon parr can be produced in waters of low mineral content. (Authors summ.)

11407. Kipling, C., and W. E. Frost (Freshwater Biol. Assn., The Ferry House, Ambleside, Westmorland, England). 1969. VARIATIONS IN THE FECUNDITY OF PIKE Esox lucius L. IN WINDERMERE. J. Fish Biol. 1, 221-237.

Egg counts were made from pike from Windermere in four consecutive years, and the mean numbers of eggs per gram of total fish weight were estimated for each year. There was no significant difference between the mean numbers of eggs per gram of total fish weight between the first two years, but the means in the subsequent years were each in turn very significantly higher than the mean in the previous year. The variation between individual pike in the number of eggs per gram of total fish weight in any one year was considerable; the fish with the highest number always had at least twice as many as the fish with the lowest number. Similar variation has been reported from other countries. An attempt was made to relate the observed changes in the number of eggs per gram of total fish weight with environmental conditions which occurred one and two years before the eggs were due to be spawned. There was no apparent association between temperature, growth and food supply with the number of eggs per gram of total fish weight, but the rise in egg numbers occurred after the population density of adult pike had been falling for several years. It is suggested that changes in the number of eggs per gram of total fish weight could be a density dependent population regulating mechanism. (Authors summ.)

11408. Roedel, Philip M., and Herbert W. Frey. 1968. CALIFORNIA-BASED FISHERIES OFF THE WEST COAST OF MEXICO FOR TEMPERATE TUNAS, MARKET FISH, AND SPORT FISH. Calif. Dept. Fish and Game, Fish Bull. (138): 49-76.

11409. Weldon, Lyle, W., and Robert D. Blackburn. 1967. WATER LETTUCE—NATURE, PROBLEM, AND CONTROL. Weeds, 15(1): 5-9.

Water lettuce (Pistia stratiotes L.) was susceptible to applications of 6.7 dihydrodipyrido (1, 2-a:2', 1'-c) pyrazidiinium salt (diquat). The most satisfactory rates of application were 1.0 to 1.5 lb/A of diquat. The addition of a surfactant did not increase the effectiveness of diquat. Several other chemicals gave unsatisfactory control of water lettuce. (Authors)

11410. Herke, William H. (Louisiana Cooperative Fishery Unit, La. St. Univ., Baton Rouge, La.). 1968. WEIRS, POTHOLES AND FISHERY MANAGEMENT. Proc. Marsh and Estuary Mgmt. Symposium, La. State Univ., Baton Rouge, La. p. 193-211.

Weirs are defined as submerged structures placed in marsh tidal channels to partially stabilize water levels. Over a quarter-million acres of coastal marsh in Louisiana, and several thousand acres in Maryland, are managed through the use of weirs. No state on the Atlantic or Gulf coasts has more than a few hundred acres of potholes in salt or brackish marsh. Benefits and disadvantages of these management practices are discussed; however, there is almost no published information regarding the effects of weirs on fishery resources. Therefore, results are reported from a six-month study conducted to determine some of the effects of a single large weir on fishery resources. Tide, salinity and water temperature records were gathered throughout the study. Quantitative sampling was accomplished with a surface trawl. Other sampling techniques were also used. At least 40 species were captured during the six months. Possible effects of the weir are analyzed in varying degrees for Anchoa, Brevoortia, Leiostomus xanthurus, Lucania parva, Menidia beryllina, Micropogon undulatus, Mugil cephalus, Callinectes sapidus, Paleomonetes pugio and Penaeus aztecus. It appears that the weir may have benefited some of these species, harmed others and had no detectable effect on others. Weirs offer a means of modifying habitat at a low cost per year per acre affected. Therefore weir construction will continue. Research should also continue to determine how to mitigate any damages, and how to obtain fishery benefits, through the use of weirs. (Auth.)

11411. Kariya, Teiji, Reiko Akiba, Shuko Suzuki, and Tsutomu Tsuda. 1967. STUDIES ON THE POST-MORTEM IDENTIFICATION OF THE POLLUTANT IN THE FISH KILLED BY WATER POLLUTION—IV. DETECTION OF CYANIDE IN THE FISH. Bull. Jap. Soc. sci. Fish., 33(4): 311-314.

The toxic effects of potassium cyanide on aquatic organisms have been reported by some workers. However, there is apparently no published report on the lethal dose of cyanide in fish. When fish were maintained in water containing cyanide, it was found that the concentration of cyanide decreased remarkably. It is probably due to some removal into the fish, and volatilizing by fish-respiration and movement. Cyanide was determined by the Pirizin-Pirazoron method; it was found in killed fish in lethal concentration. It was also possible to detect cyanide even after washing with tap water for 48 hours after death. Cyanide could not be detected in untreated control fish. It was concluded that this method can be used as one of the methods for post-mortem identification of the pollutant in fish killed by water pollution. (Authors)

11412. Kitamura, Sasaburo, Tomio Suwa, Syuhei Ohara, and Kenichi Nakagawa. 1967. STUDIES ON VITAMIN REQUIREMENTS OF RAINBOW TROUT—II. THE DEFICIENCY SYMPTOMS OF FOURTEEN KINDS OF VITAMIN. Bull. Jap. Soc. sci. Fish., 33(12): 1120-1125.

The vitamin requirements of rainbow trout, Salmo gairdneri, were qualitatively examined with the fingerlings. A vitamin test diet was pelleted, broken into crumbles and fed. The 14 kinds of vitamin, A, D, K, B_1, B_2, B_6, B_{12}, C, nicotinic acid, pantothenic acid, inositol, folic acid, biotin and choline were individually eliminated from the complete diet. Specific deficiency syndromes were observed on the following vitamins: vitamin A, K, B_1, B_2, B_6, and C, pantothenic acid, inositol, folic acid and choline. These syndromes coincided fairly well with those

reported by previous workers. Among the vitamins inducing no deficiency syndromes, nicotinic acid and biotin were determined to be 0.27γ and 0.01γ per gram of the basal diet on dry basis, but vitamin D and B_{12} were not detected. (Authors)

11413. Ghittino, Pietro. 1967. ETIOLOGY AND ANATOMO-PATHOLOGICAL CHANGES IN "GILL DISEASE" (GD) OF TROUT FINGERLINGS IN ITALY. Riv. It. Piscic. Ittiopat. 3(2): 24-29.

The author reviews the literature on the gill disease (GD) of young hatchery salmonids. He reports the findings of many practical observations on the disease which occurred in Italy in the last three years. The characteristics of GD observed by the author are in agreement with those referred in the literature, especially concerning the anatomo-pathological changes of the gills (gill-clumping, -epithelial hyperplasia, -lamellae fusion, -microhematomas, etc.). Starting from the observations of many cases of the disease, the author reports an interesting hypothesis on the etiopathogenesis of GD. The disease arose with remarkable frequency in trout fingerlings affected with external parasites (especially with Ichthyophthirius and Costia), but even more in fish fed dusty dry feeds. The author suggests that GD is a reaction which is analogous to the irritations induced by different stimuli, and he partially confirms the previous hypothesis on the disease. Nevertheless, he attributes the greater role to dusty dry feeds, rather than to pantothenic-acid-deficient feeds, since trout dry-diets generally contain enough B-complex - high ingredients. Finally, the author reports the measures taken in Italy to prevent and control GD. Experimental researches are now being performed for the purpose of elucidating the etiopathogenesis of the disease. (Auth. summ.)

11414. Shetter, David S. 1968. THE EFFECTS OF CERTAIN ANGLING REGULATIONS ON STREAM TROUT POPULATIONS. Mich. Dept. of Conserv., Res. and Dev. Report 153, 42 p.

Annual fall brook trout population estimates, yearly angler catches, and a large series of scale samples from 1.75 miles of Hunt Creek, Montmorency County, Michigan, for 1950-1965, provided data for assessment of the effects of a fly fishing only restriction (instead of any lure) on the brook trout population. The restriction (in effect during 1955-1959) did not affect the total mortality rate or the population structure of the brook trout. Similar but less precise information was collected from 19.8 miles of the North Branch of the Au Sable River for brook trout and brown trout during 1960-1967. Here comparative restrictions included "flies-only," higher minimum size limit (9 inches instead of 7 inches), lower daily creel limit (5 fish instead of 10 fish). Total mortality and angling mortality rates for brook trout were significantly higher in the less restricted stream area: the restrictions had little effect on the brown trout populations. (Auth.)

11415. Kennedy, C. R., and P. M. Hine (Dept. of Zoology, Univ. of Exeter, England). 1969. POPULATION BIOLOGY OF THE CESTODE Proteocephalus torulosus (BATSCH) IN DACE Leuciscus leuciscus (L.) OF THE RIVER AVON. J. Fish Biol. 1, 209-219.

The distribution and abundance of Proteocephalus torulosus infecting a population of dace Leuciscus leuciscus were studied over a period of two years. Records of incidence, burden and maturation show that the parasite exhibits seasonal cycles, being present only from November or December until June or July and becoming gravid in April. The degree of infection increased with the size of the fish and the negative binomial could be taken as a satisfactory model of the parasites' distribution. While annual river temperature changes may influence the growth rate of the parasites they appear to have little or no direct effect upon maturation, establishment or loss of worms. The population biology of P. torulosus is very similar to that of the cestode Caryophyllaeus laticeps in the same fish population and differs considerably from that of other fish tapeworms. It is postulated that seasonal differences in resistance of dace to infection which are

directly dependent upon river temperature are responsible for the observed seasonal rhythms in incidence and abundance and for the pattern of infection in the fish population. (Authors summ.)

11416. Tedla, Shibru, and C. H. Fernando (Dept. of Biol., Univ. of Waterloo, Waterloo, Ontario, Canada). 1969. OBSERVATIONS ON THE GLOCHIDIA OF Lampsilis radiata (GMELIN) INFESTING YELLOW PERCH, Perca flavescens (MITCHILL) IN THE BAY OF QUINTE, LAKE ONTARIO. Canad. J. Zool. 47(4): 705-712.

Analysis of incidence and intensity of infestation of yellow perch, Perca flavescens (Mitchill), by the glochidia of Lampsilis radiata from weekly samples from May to September and single samples in October and November indicate that the two subspecies, Lampsilis radiata radiata and Lampsilis radiata siliquoidea, shed their glochidia in late spring and throughout the summer in the Bay of Quinte, Lake Ontario. Smaller fish are more heavily infested with these glochidia than larger ones. About 50% of the preparasitic glochidia of Lampsilis radiata siliquoidea survived for 12, 70, and 120 h at 20°, 12°, and 10°C respectively. The parasitic period of the glochidia of L. r. siliquoidea on yellow perch under experimental conditions was 50 days at 15°C from the May infestation. Yellow perch carried the glochidia for a longer period from an August infestation. All the glochidia, recovered 50 days after infestation, both from May and August infestations, had undergone metamorphosis. There was no difference in the degrees of infestation of the different species of fish used in our experiments. Pumpkinseed, Lepomis gibbosus (Linnaeus); rock bass, Ambloplites rupestris (Rafinesque); and white perch, Roccus americanus (Gmelin) lost their infestations in a week. Presumably no metamorphosis took place under these conditions. Black crappie, Pomoxis nigromaculatus (LeSueur); largemouth bass, Micropterus salmoides (Lacepede), smallmouth bass, M. dolomieui Lacepede; and yellow perch carried the infestation till they were killed 20 days later. There was no relationship between the numbers of glochidia (Lampsilis radiata) and copepods, (Ergasilus confusus Bere) on naturally infested yellow perch, nor on rock bass, smallmouth bass, and pumpkinseed which harbored Ergasilus spp. naturally and which were infested with the glochidia of L. r. siliquoidea experimentally. (Authors)

11417. Shipp, Robert L., and Ralph W. Yerger. 1969. STATUS, CHARACTERS, AND DISTRIBUTION OF THE NORTHERN AND SOUTHERN PUFFERS OF THE GENUS Sphoeroides. Copeia, No. 3, pp. 425-433.

Sphoeroides maculatus, the northern puffer, and S. nephelus, the southern puffer, are distinct species whose ranges overlap along a short distance of the northeast Florida coastline between Jacksonville and Marineland. The northern puffer ranges northward to Newfoundland; the southern puffer extends southward throughout most of the Caribbean and the eastern half of the Gulf of Mexico. No specimens were found from or near the narrow zone of sympatry which would indicate intergradation or hybridization. In addition to distinct pigmentation patterns, certain morphological characters differ between the two species: S. maculatus has a higher number of pectoral rays, a wider interorbital, and a greater area of body surface covered with prickles. Pronounced ecological differences are also noted. S. harperi is a junior synonym of S. nephelus. Many specimens of S. nephelus from south Florida and the Caribbean have previously been mis-identified as S. marmoratus. The correct spelling of the generic name is established as Sphoeroides. (Authors)

11418. Berry, Frederick H. 1969. Elagatis bipinnulata (PISCES: CARANGIDAE): MORPHOLOGY OF THE FINS AND OTHER CHARACTERS. Copeia, No. 3, pp. 454-463.

The monotypic Elagatis bipinnulata is characterized by having only two anal spines and a two-rayed finlet at the end of the dorsal and anal fins. Ontogeny of finlet formation and the fin rays and their relation to internal supporting bones are described. (Auth.)

11419. Eckroat, L. R., and J. E. Wright. 1969. GENETIC ANALYSIS OF SOLUBLE LENS PROTEIN POLYMORPHISM IN BROOK TROUT, Salvelinus fontinalis. Copeia, No. 3, pp. 466-473.

Soluble lens proteins of inbred strains and their hybrids of brook trout were examined by acrylamide gel electrophoresis. Variations were observed in the presence or absence of different fractions as well as in the optical density of one fraction. These polymorphisms were shown to be genetic from analyses of families within and among the various fish strains. Data collected on the progenies from matings between individuals of predetermined phenotypes confirmed that two fractions are inherited in a simple Mendelian manner. Since the genes appear to segregate independently, these characters should be well adapted for use in characterizing brook trout populations. (Authors)

11420. Smith, M. W., and P. Kemp (Agricultural Res. Council Inst. of Animal Physiology, Babraham, Cambridge, England). 1969. PHOSPHOLIPASE C-INDUCED CHANGES IN INTESTINAL ADENOSINE TRIPHOSPHATASE PREPARED FROM GOLDFISH ACCLIMATIZED TO DIFFERENT TEMPERATURES. Biochem. J. No. 114, pp. 659-661.

The present paper shows that incubation of goldfish membranes with phospholipase C inhibits the $Na^{+}+K^{+}$-stimulated ATPase activity and enhances the Mg^{2+}-stimulated ATPase activity of membranes from cold-adapted fish. The Mg^{2+}-stimulated ATPase activity of membranes from warm-adapted fish is not changed during incubation with phospholipase C. An attempt was made to relate these findings to the normal operation of the ATPase system in goldfish intestinal membranes. (Authors)

11421. Weinreb, Eva Lurie, and Stanley Weinreb (Dept. of Biology, New York Univ., New York, N. Y.). 1969. A STUDY OF EXPERIMENTALLY INDUCED ENDOCYTOSIS IN A TELEOST. I. LIGHT MICROSCOPY OF PERIPHERAL BLOOD CELL RESPONSES. Zoologica, 54(1): 25-34.

The peripheral blood picture of the goldfish, Carassius auratus, was studied to determine cell functions and analogies to mammalian cell types. Blood samples were collected at intervals, over a 26 hour period, from fish which had received a single intraperitoneal injection of Thorotrast. Stained blood smears were examined for qualitative and quantitative changes. The mean $\pm$ S.E. and 95% range were determined for all leukocytes. Responsive elements were lymphocytes, immature and mature neutrophils, and a variety of blast cells. Lymphopenia and neutrophilia persisted for six hours. All neutrophilic maturation stages were present. The reaction decreased after 12 hours, and the blood picture began to normalize after 18 hours. The rare macrophages did not respond. Mononuclear phagocytes were limited to lymphocytes and blast cells. The lymphoid hemoblasts are analogous to mammalian macrophages studied under similar conditions. Immature blood cells of the teleost have the potential for endocytosis as well as cell proliferation and differentiation. Consideration is given to the probable role of the lymphocyte in hemopoiesis and endocytosis. (Authors)

11422. Mawdesley-Thomas, Lionel E., (Dept. of Pathology, Huntingdon Res. Centre, Huntingdon, England). 1969. NEOPLASIA IN FISH—A BIBLIOGRAPHY. J. Fish Biol. No. 1, 187-207.

11423. Hill, Loren G., (Dept. of Zoology, Univ. of Oklahoma, Norman, Okla.). 1969. FEEDING AND FOOD HABITS OF THE SPRING CAVEFISH, Chologaster agassizi. Amer. Midl. Nat. 82(1): 110-116.

11424. Renfro, George, Jr., (Soil Conservation Service). 1968. SEALING LEAKING PONDS AND RESERVOIRS). U. S. Dept. of Agriculture, Soil Conserv. Serv., SCS-TP-150, 6 p.

11425. Laarman, Percy W. 1968. GROWTH RATES OF COHO SALMON AND STEELHEAD TROUT WITH A LIMITED FOOD SUPPLY. Mich. Dept. of Conserv., Res. and Development Report No. 150, 18 p.

Competition between coho salmon and steelhead trout was studied by comparing specific growth rates of the two species in a laboratory raceway. The raceway was partitioned into six test compartments, each 5 feet long by 14 inches wide; each compartment had flowing water of about 45 gallons per minute with temperature averaging 57°F and dissolved oxygen 6.5 ppm. Fingerling salmon and trout of similar size were compared, and tests were run on fingerlings 2.3 to 3.0 inches in length and also on fingerlings 3.6 to 4.1 inches long. The fish were fed the Oregon moist pellet from 5 October to 20 December 1967. Daily feeding rates were kept below optimum and ranged from 1.8% to 3.6% of body weight. When trout and salmon below 3.3 inches were held together in the same raceway, the trout grew at a significantly faster rate; in other words steelhead trout were dominant over coho salmon in utilizing food from a limited supply. Above 3.3 inches the growth rate of the experimental trout was also greater than that of the salmon, although the difference was not significant at the 95% confidence level. Specific growth rates were dependent on the initial sizes of the fish. (Auth.)

11426. Yamashita, Hideo. 1967. HAEMATOLOGICAL STUDY OF A SPECIES OF ROCKFISH—II. CHANGES OF THE MOISTURE CONTENT OF BLOOD, SPECIFIC GRAVITY, SERUM PROTEIN, HAEMATOCRIT VALUE AND UREA NITROGEN LEVEL OF SERUM IN THE SPECIMENS AFFECTED BY ULCERS. Bull. Jap. Soc. sci Fish., 33(11): 995-1001.

During an experiment which was being carried out to analyse the influence of chlorinity on the blood elements of a species of rockfish, Sebastiscus marmoratus, some specimens kept in the experimental tanks incidentally developed ulcers. Examinations of the blood elements were therefore carried out in order to compare the amount of each constituent under normal and diseased conditions. Symptoms of ulcers appeared first on the spines and fin rays of the dorsal fin, on the opercula, between the pectoral and ventral fins, between the dorsal fin rays and anal fin, and on the caudal peduncle as well as the caudal fin. On these parts, the color turned to a greyish white, probably owing to the aggregation of melanin granules in the melanophores. The suffering individual was likely to isolate itself from the original group and remain singly in the experimental tank. Although activities of such fish were very low, their response to a slight stimulation, sound for example, was extremely sensitive. Later the condition of the illness took a serious turn; the neural spines, caudal vertebrae and urostyles could be seen from the outside, since a part of the epidermis was damaged at this stage of the disease. The color of the gill and Cuvierian duct turned to a yellowish orange in spite of the original color being dark red in healthy specimens. When the ulcer reached a serious stage, the specific gravity of the blood decreased considerably, while the moisture content of the blood increased from 89.9% to 91.5%. The amounts of serum protein in ill specimens were also a little (0.3-4.0%) less than those of normal individuals. Similarly, the haematocrit values decreased remarkably (8-16%) when a fish had an ulcer. In a specimen whose haematocrit value was lowered from 19.3% to 3.0%, the leucocyte concentration went up to about 2.5%, which seemed to be much higher than that of normal individuals. A test with urea-nitrogen chromatographic paper gave no positive reaction on the serum of normal fish. However, a value of 10 mg/100 ml was obtained when the ulcer began to develop, and it reached up to 40 mg/100 ml when the fish was seriously affected by the ulcer. (Auth.)

11427. Webb, R. T., and F. R. Richardson. 1969. DIVISION OF FISHERY SERVICES ANNUAL REPORT FOR 1968. U. S. Dept. of the Interior, Fish and Wildlife Service, Bur. of Sport Fisheries and Wildlife, RP 79, 60 p.

11428. Aoe, Hiroshi, Isao Masuda, Takashi Saito, and Toshiko Takada. 1967. WATER-SOLUBLE VITAMIN REQUIREMENTS OF CARP—V. REQUIREMENT FOR FOLIC ACID. Bull. Jap. Soc. sci. Fish., 33(11): 1068-1071.

The requirement of young carp for folic acid was studied, using the basal diet devised by HALVER et al. In feeding trials for 16 weeks, no deficiency symptoms were observed in gross observation. Moreover, the addition of sulfanilamide to the diet or omission of both folic and p-aminobenzoic acids from the diet revealed no effect on growth and mortality. Under the experimental conditions adopted, an inconclusive result was obtained on the requirement for folic acid. (Authors)

11429. Nair, K. K. 1968. A PRELIMINARY BIBLIOGRAPHY OF THE GRASS CARP, Ctenopharyngodon idella Valenciennes. FAO Fish. Circ. 302, 15 p.

Due to its habit of feeding voraciously on aquatic and even terrestrial vegetation, the grass carp is considered a promising biological agent for the control of aquatic weeds. Its culture is therefore receiving increasingly wider attention in both tropical and temperate countries and it has been introduced into many countries of Asia, Africa, Europe and North and Central America. Till recent years the fish culturists had to depend largely on fry collected from the spawning grounds of the Chinese carps in their home waters in China for cultivation, as they could not be bred under captivity. Except for a very few instances, they have not been observed to breed outside their home waters in mainland China and the eastern part of the U. S. S. R. The technique of induced breeding developed in China, Taiwan and India has now made it possible to breed the grass carp as well as the other Chinese carps in any part of the world. Experimental studies as well as pilot projects in the culture of grass carp are now underway in many countries of the world and consequently there has been compiled to meet the immediate need for such information, a preliminary bibliography in response to many requests for information on the species. (Auth.)

11430. Kennedy, M., (Inland Fisheries Trust, Inc.). 1969. IRISH PIKE INVESTIGATIONS. SPAWNING AND EARLY LIFE HISTORY. Irish Fish. Investigations, Series A (Freshwater), No. 5, pp. 4-33.

The spawning of pike (Esox lucius) was studied in 1965 and 1966 in five large Irish limestone lakes—Loughs Sheelin, Ennel, Mask, Corrib and Arrow. The spawning period was found to be February to April. Spawning took place in shallow, sheltered situations where there was a carpet of dead or living vegetation on the bottom at a depth of 20 to 60 cm. Spawning took place by day, at a water temperature of at least 9° - 10°C, when lake levels were high or rising. Gill-net catches reached a peak during periods of spawning. Weather conditions in February and March were much milder in 1966 than in 1965, and spawning began about a month earlier than in 1965. The eggs of Irish pike are 2.7 to 3.0 cm in diameter. They are golden to honey coloured, with a great many minute oil-globules distributed through the yolk in numerous tiny clusters. The incubation period in the field is probably 8 - 14 days, and the newly hatched larva is 8.0 - 9.0 mm long. For the first 10 days or so, the larvae hang vertically from the vegetation by means of adhesive glands on the head. They then become free-swimming, and soon afterwards begin to feed. At this stage they measure 13.0 - 13.5 mm. Their first food consists of small caldocera and copepods. Later, they feed on larger cladocera, amphipods, isopods, young stages of aquatic insects, and fish fry. (Auth.)

11431. Dill, William A., and T. V. R. Pillay. (Inland Fishery Branch, Dept. of Fisheries, FAO of the United Nations, Rome, Italy). 1968. SCIENTIFIC BASIS FOR THE CONSERVATION OF NON-OCEANIC LIVING AQUATIC RESOURCES. FAO Fish. Tech. Paper No. 82, 15 p.

11432. Went, A. E. J. 1969. IRISH KELT TAGGING EXPERIMENTS 1961/62 TO 1966/67. Irish Fish. Investigations, Series A (Freshwater), No. 5, pp. 35-47.

A total of 14, 881 kelts (Atlantic salmon) were tagged on ten Irish river systems in the years 1962 to 1967 together with small numbers of fish immediately before spawning in Carrowmore Lake in Co. Mayo. A total of 296 clean tagged fish were recovered. Of these 76.0% were recovered in the river or the estuary of the river where tagging had been carried on, 21.6% in the open sea or the tidal waters of the rivers and only 2.4% in the freshwater portion of a river other than that where tagging was carried on. (Auth.)

11433. Tuffery, G., and J. Verneaux. 1968. A METHOD FOR THE DETERMINATION OF RIVER WATER BIOLOGICAL QUALITY. (Méthode de détermination de la qualité biologique des eaux courantes). Centre National d'Études Techniques et de Recherches Technologiques pour l'Agriculture, les Forêts et l'Équipment Rural, Section Pêche et Pisciculture, 21 pp.

The Agricultural Ministry Technical Departments (C.E.R.A.F.E.R. Technical Fishery and Fish-breeding Section) which were entrusted with surface water study and checking, tried to develop a method for evaluating water quality contemplated from the biological viewpoint. The method, designed to be used with the available vehicles (Laboratory-cars driven by specially trained operators) ought to apply to a generalized inventory of water qualities. The method developed and used by the TRENT RIVER BOARD in Great Britain presented the requisite qualities and was suited to the French water characteristics. From a biological viewpoint, water quality evaluation is based upon a benthic and periphytic macrofauna sampling. A gross mark of "biotic number" is given according to a standard diagram and to the nature and number of species encountered. A distinct sampling is made for each facies: still (lentic) and flowing (lotic) facies. In order to interpret the results and show the biological modifications due to water quality, 23 data concerning environment are recorded in a coded way. Each station under examination is characterized by 3 data: biotic number in lentic facies, number difference between both facies. The interpretation of these data is expounded in the text. In addition to water quality evaluation for a given station and within a general river pattern study, it is possible to determine the intensity of pollutions and importance of polluted areas as well as river self-purifying capacity for the kind of pollution under study. The various data thus codified and collected are suitable for analysis by means of a punched card process; they may be used as exceptional documents for studies of theoretical and applied ecology. (Authors)

11434. Ellis, Robert J. (Bur. of Comm. Fish. Biol. Lab., Auke Bay, Alaska). 1969. RETURN AND BEHAVIOR OF ADULTS OF THE FIRST FILIAL GENERATION OF TRANSPLANTED PINK SALMON, AND SURVIVAL OF THEIR PROGENY, SASHIN CREEK, BARANOF ISLAND, ALASKA. U. S. Fish Wildl. Serv., Spec. Sci. Rep. Fish. No. 589, 13 p.

Escapement of adult pink salmon to Sashin Creek in 1966 was 5,761 fish -- mostly progeny of 1,866 adults transplanted to the stream in 1964. The adults entered Sashin Creek relatively early in the season and within a short period of time. Most of them spawned in the same two study sections of Sashin Creek ("Lower and "Middle") used by their parents and by earlier native runs of similar size. The two sections had nearly equal densities of females (about 0.27 per square meter) and potential egg deposition (about 570 eggs per square meter) but different efficiencies of egg deposition (about 47 percent in the Middle section and 28 percent in the Lower). The low average efficiency for the entire stream (37 percent) was probably due to the high streamflow during the spawning season. The proportion of combined eggs and alevins alive in March was nearly equal in the Middle and Lower sections (63 and 65 percent), but the disappearance from the end of spawning to just before emergence was markedly different -- about 80 percent for the Middle section and 47 percent for the Lower. Total survival from potential egg deposition to preemergent fry was 9 percent in the Middle section and 15 percent in the Lower. Estimated number of pink salmon fry produced in Sashin Creek in the spring of 1967 was 750,000 or 12 percent of the

potential egg deposition of 6,255,000. This is the survival predicted from the historical relation of total fresh-water survival to the date half the spawners entered the stream. Several lines of circumstantial evidence indicate that the adult pink salmon that spawned in Sashin Creek in 1966 were mostly progeny of the fish transplanted to the stream in 1964.

11435. Brooks, John Langdon. 1968. THE EFFECTS OF PREY SIZE SELECTION BY LAKE PLANKTIVORES. Systematic Zoology, 17(3): 273-291.

Although the biomass of the planktivorous fish in any lake is but a few percent of that of the plant and animal plankton, these fish exert a potent influence upon the composition of these lower trophic levels. The vulnerability of the zooplankton to predation, together with the high degree of selectivity exercised by the planktivores in their choice of prey items are responsible for this pervasive effect. Freshwater planktivores appear to prefer large Cladocera, especially Daphnia. Trout and yellow perch, facultative planktivores, switch to non-planktonic food when large Daphnia are not available. Freshwater populations of the primarily marine genus Alosa are obligate planktivores, shifting to progressively smaller zooplankters as the larger, preferred items become scarce. Within each prey category there is strong preference for the largest items. In an experimental observation of Alosa sp. feeding on a small calanoid copepod, the survival time of each instar was inversely proportional to its mean body length. The strong preferences evinced by lacustrine planktivores can shift the competitive balance between the zooplanktonic herbivores, all of which exploit the same supply of particulate food. Whenever or wherever planktivores are absent, large zooplankters like Daphnia pulex are numerically dominant. When planktivory is more intense the large zooplankters are cropped sufficiently to allow smaller, hitherto suppressed, species to become numerous. The interest displayed by facultative planktivores toward decreasing sizes of prey is considered in relation to the shape-size polymorphism characteristic of most limnetic Daphnia. (Auth.)

11436. European Inland Fisheries Advisory Commission Working Party on Water Quality Criteria for European Freshwater Fish. 1969. WATER QUALITY CRITERIA FOR EUROPEAN FRESHWATER FISH—WATER TEMPERATURE AND INLAND FISHERIES. Water Research Pergamon Press No. 3, pp. 645-662.

In establishing water quality criteria for European inland fisheries, temperature plays an important role, since industry uses substantial quantities of water for cooling purposes. There is a normal range of temperatures in the temperate region between 0 and 30°C, to which fish are adapted. Fish differ, however, in their tolerance to high temperature, depending on species, stage of development, acclimation temperature, dissolved oxygen, pollution, season and the extent to which the environment is heated. In this report, tentative temperature criteria are proposed which take no account of the effect of pollution. It was essential to make a distinction between the temperature conditions permissible at different times of the year and to assess not only maximum permissible temperatures but also maximum permissible increments of temperature. (Authors)

11437. Askerov, T. A. 1968. A METHOD FOR CONTROL OF SAPROLEGNIAL FUNGUS. (Metod bor'by s saprolegnievym gribkom). Rybnoe Khozyaistvo, October 10, 1968, Moscow, 23-24. Translated by Robert M. Howland, Division of Fishery Research, Bureau of Sport Fisheries and Wildlife, Washington, D. C.

Tests showed that a malachite green solution of 1:100,000 has a destructive effect on Saprolegnia, and is harmless to wild-carp spawn. The application of malachite green improves the results of spawn incubation in the Yushchenko apparatus by 25 percent, the Veisa - by 23 percent, the Ses-Grina - by 18 percent. Thus, it is expedient to use a malachite green solution during incubation of wild-carp spawn in apparatuses, in order to control Saprolegnia. (Auth.)

11438. Kubota, Minoru, and Shigeru Kimura. 1967. SKIN COLLAGEN OF THE GREAT BLUE SHARK. Bull. Jap. Soc. sci. Fish., 33(4): 338-342.

Acid-soluble collagen prepared from the skin of the great blue shark is characterized with regard to physicochemical properties and amino acid composition. The skin collagen of the great blue shark, one of the lower forms of vertebrates, is similar to that from higher vertebrates in some physicochemical properties, while there is slight difference in the amino acid composition. High solubility in dilute acid and a low content of cross-links are the most characteristic features of skin collagen from the great blue shark. (Authors)

11439. Berg, A., and E. Grimaldi. (Biology Div., EURATOM, 21020 Ispra, Italy). 1967. A CRITICAL INTERPRETATION OF THE SCALE STRUCTURES USED FOR THE DETERMINATION OF ANNULI IN FISH GROWTH STUDIES. Mem. Ist. Ital. Idrobiol., 21: 225-239.

Terminology employed in scale-reading is reviewed briefly. Criteria to be adopted for recognition of the annuli on fish scales are then discussed, together with the significance of these structures in studies on fish growth. Owing to the complete cessation of growth during the cold season, a "stop growth annulus" is potentially present during that period. This annulus then becomes evident at the time of growth resumption. In such instances, the back-calculated fish lengths from scale measurements are those which have been attained at the end of each growth season and maintained during the entire cold season. Unequivocal comparison of growth data among populations or species is then possible on the basis of these calculated "winter lengths", independently of the time of annulus appearance in spring, which may show a considerable variation. Therefore, it is suggested to replace the expression "time of annulus formation" with the more adequate and less equivocal expression "time of annulus appearance". (Authors)

11440. Matida, Yoshihiro, Sekio Kimura, Chosei Yoshimuta, Hiroshi Kumada, and Eimatsu Tokunaga. 1967. A TOXIC FRESH-WATER ALGAE, Glenodinium gymnodinium PENARD, CAUSED FISH KILLS IN ARTIFICIALLY IMPOUNDED LAKE SAGAMI. Bull. Freshw. Fish. Res. Lab., Tokyo, 17(2): 73-77.

In 1962 fish kills were noted in inlets of an impounded Lake Sagami. Fish kills occurred from mid-September to November. All fish in the shallow area were affected regardless of age or size. Some of the dead fish floated and some sank to the bottom. Adequate dissolved oxygen was present when the fish kills occurred. Temperature and pH were in the normal range. The dominant alga was Glenodinium gymnodinium. Algae was mostly in the upper meter of water. Fish did not exhibit any marked avoidance of the algal bloom. Examination showed that gill rakers and gill filaments of dead fish were partly clogged with algae. A filtrate of the algae was toxic to small fish. It is not known whether the toxic substance is produced by the algae or by the bacteria associated with the bloom. No algicide was used as the impoundment is used as a water supply for cities. (Authors)

11441. Shiraishi, Yoshakazu, and Minoru Tanaka. 1967. FEEDING HABIT OF BROWN TROUT, Salmo trutta, IN LAKE CHUZENJI. Bull. Freshw. Fish. Res. Lab., Tokyo, 17(2): 87-95.

Analysis of stomach contents of 240 brown trout, taken from Chuzenji Lake, Tochigi Prefecture, from May 1962 to October 1966, was conducted to show the food habits of the fish and the relation between this species and other salmonid fishes. A total of 32 different food organisms were found, consisting of 13 species of aquatic insects, 8 terrestial insects, 2 Crustacea, 3 Mollusca, one frog and 5 fish. Brown trout eat mainly aquatic insects from February until April, and insects in June and July; then most of them eat forage fish. There is no relation between the size of the predator and the forage fish when the forage fish is small, but a positive relation is seen when the forage fish is bigger. While 32 species were found in all, individual fish contained only a few species or groups of food organisms. (Authors)

11442. Nose, Takeshi. 1967. ON THE METABOLIC FECAL NITROGEN IN YOUNG RAINBOW TROUT. Bull. Freshw. Fish. Res. Lab., Tokyo, 17(2): 97-105.

Ad libitum feeding and force feeding of a protein-free diet were conducted to determine metabolic fecal nitrogen in young rainbow trout. Apparent and true protein digestibilities were determined by feeding milk casein, egg albumin, white fish meal and defatted soybean meal at different levels. In the ad libitum feeding, the fish excreted fecal nitrogen from 28 to 169 mgN, with an average of 95 mgN, per 100 gram dry protein-free diet, and in force feeding from 86 to 151 mgN with an average of 125 mgN. The relationship was examined between fecal nitrogen output and the protein content in the diet at varying levels of four kinds of protein. A linear relationship was observed with each protein diet except the egg albumin diet. Metabolic fecal nitrogen was estimated by extrapolation of the regression line to zero protein intake, with the results of 109, 39 and 130 mgN, respectively, for milk casein, white fish meal and defatted soybean meal. It was concluded that true digestibility of diet protein is constant and independent of the protein level in the diet, though the apparent digestibility decreases at lower protein levels. The estimated true digestibility was 99.5% for milk casein, 83.9% for egg albumin, 91.9% for white fish meal and 92.4% for defatted soybean meal, and metabolic fecal nitrogen excreted by young rainbow trout was in the range of 50 to 150 mgN per 100 grams of dry diet consumed. (Auth. summ.)

11443. Sundararaj, Bangalore I., and Shashi V. Goswami. (Dept. of Zoology, Univ. of Delhi, Delhi, India). 1968. EFFECTS OF ESTROGEN, PROGESTERONE, AND TESTOSTERONE ON THE PITUITARY AND OVARY OF CATFISH, Heteropneustes fossilis (BLOCH). J. exp. Zool., 169(2): 211-219.

Estradiol benzoate (EB), testosterone propionate (TP) and progesterone have been administered orally over 45 days during the late preparatory period to intact female catfish showing ovarian recrudescence. EB or TP treatment brings about a reduction in the size and number of basophils in the pituitary, and inhibition of vitellogenesis in the ovaries. Progesterone administration causes partial ovarian regression without significantly altering pituitary cytology. The sexually dimorphic urogenital papilla which is inconspicuous and nonmuscular in the female is unaffected by hypophysectomy and/or EB treatment. TP induces complete masculinazation of the female papilla, whereas progesterone is only marginally effective. EB injections over 15 days to intact catfish having ovaries containing yolk laden oocytes induce significant reduction in the number of pituitary basophils and extensive follicular atresia in the ovaries. Administration of EB to hypophysectomized catfish inhibits hypertrophy of the granulosa cells surrounding the yolky oocytes and thus delays the impending follicular atresia. The significance of these findings is discussed. (Authors)

11444. Monakov, A. V. 1968. THE CYCLOPID FAUNA OF THE LITTORAL ZONE OF RYBINSK RESERVOIR. (Fauna tsiklopid pribrezhnoi zony Rybinskogo vodokhranilishcha). Biologiya i Troficheskie Svyazi Presnovodnykh Bespozvonochnykh i Ryb. Sbornik Statei Akademiya Nauk SSSR, Institute Biologii Vnutrennikh Vod, Trudy, Nauka: Leningrad, 17(20): 33-40. Translated by Robert M. Howland, Division of Fishery Research, Bureau of Sport Fisheries and Wildlife, Washington, D. C.

Twenty-six species of cyclops live in the littoral zone of Rybinsk Reservoir, of which the most numerous four are: Acanthocyclops viridis, Macrocyclops albidus, Microcyclops varicans and M. bicolor. The degree of overgrowth and the depth of the littoral zone are factors which determine the composition, abundance and distribution of cyclopids. The maximal abundance and greatest number of species are seen in the shallows which are overgrown with sedges and horsetails; the minimal -- at greater depths among the reeds. The total biomass of cyclops during the period from May through October undergoes considerable fluctuations, but provides two clearly expressed maximums: the first -- with a biomass of 0.35 g/m^3 at the end of May, two weeks after flooding of the littoral zone; the second -- with a biomass of 0.40 g/m^3 at the end of August. Two species chiefly specify the quantity of the total biomass -- Acanthocyclops viridis and

Macrocyclops albidus. The middle of summer is characterized by numerical predominance of the small phytophilic species of Microcyclops and forms of the pelagic plankton - Mesocyclops leuckarti. (Auth. summ.)

11445. Nagayama, Fumio, Yuji Saito, and Masaro Hayashi. 1967. DISTRIBUTION OF β-GLUCURONIDASE IN FISH. Bull. Jap. Soc. sci. Fish. 33(12): 1132-1138.

β-Glucuronidase (E. C. 3. 2. 1. 31) is known to be widely distributed in animal tissues, but information about the enzyme in fish is scarce. In this experiment, the enzyme distribution in various fish tissues was investigated by the chemical and histochemical methods. Although the enzyme activity of tissue varies with fish species, the most active tissue is usually the liver or kidney followed by the spleen. The granules showing the enzyme reaction are widely distributed in the tissues of the liver, pancreas, spleen, and heart. In the kidney, the enzyme is localized mostly in the convoluted tubule (proximal segment), and less activity is seen in the interstitial tissue. The general aspect of the enzyme localization, being similar with that in mammals, suggests that the metabolism of glucuronides may be actively carried out in these organs of fish. The enzyme activities of the alimentary tracts of fishes do not show much difference between species; however, the localization of enzyme seems to suggest some relation between the enzyme and the feeding habit of the fish and the importance of the enzyme in food digestion. (Authors)

11446. Nagayama, Masaro Hayashi, and Katsuo Sakamoto. 1967. INHIBITION OF β-GLUCURONIDASE BY SERUM AND BILE OF FISH. Bull. Jap. Soc. sci. Fish., 33(12): 1139-1142.

The inhibitory effects of fish serum and bile on the liver β-glucuronidase of rainbow trout, as well as on bovine liver enzyme, were investigated. The β-glucuronidase of bovine liver is 81 and 93% inhibited by fresh bovine and trout sera, respectively. Trout liver enzyme is inhibited to the extent of 90 and 87% by fresh trout and bovine sera. The dialysate of the serum scarcely inhibited the enzyme at all, while the non-dialysable fraction retained the effect. The methanol extracts of the bovine serum showed only a negligible effect. The inhibition of the enzyme by bile is much more pronounced than by sera. Even such a dilute solution as 0. 5% shows considerable inhibitory effect. The influence of dialysis on the inhibitory effect of bile differs from that on sera. The dialysable fraction of carp bile apparently shows an inhibitory effect, although it is less than that of the non-dialysable fraction. Several components which show the inhibitory effect were obtained by gel filtration with Sephadex G-25. However, none of them shows competitive inhibition which is characteristic of glucarolactone. (Authors)

11447. Kitamura, Sasaburo, Tomio Suwa, Syuhei Ohara, and Kenichi Nakagawa. 1967. STUDIES ON VITAMIN REQUIREMENTS OF RAINBOW TROUT—III. REQUIREMENT FOR VITAMIN A AND DEFICIENCY SYMPTOMS. Bull. Jap. Soc. sci. Fish., 33(12): 1126-1131.

By using a test diet containing casein 50%, gelatin 20%, α-wheat starch 13%, minerals 5%, bone ash 5%, soybean oil 5%, L-tryptophan 1%, DL-methionine 1%, and vitamins, the vitamin A requirement of fingerlings of the rainbow trout, Salmo gairdneri, was examined and the deficiency symptoms were observed. Four groups of sac fry were provided, and fish were kept for six months on diets containing respectively 0, 0. 5, 2. 5 and 50 I. U. of vitamin A acetate per gram on a dry basis, and a recovery test was carried out thereafter on some of the experimental fish. Avitaminosis was characterized by retarded growth, high mortality, low hepatosomatic index and anemia. In addition, the fading of body color was recognized at an early stage and was followed by hemorrhage in the eye and at the base of fins, and reverse bending of the gill opercula. These syndromes, with the exception of reverse bending of the gill opercula, disappeared rapidly in a few weeks in the recovery test. On the basis of body weight gain, the requirement for vitamin A was estimated to be more than 2. 5 I. U. per gram of dry diet in the fingerling weighing less than 7 grams, and approximately 2. 5 I. U. or less in larger fish. (Authors)

11448. Bell, Gordon R., Gary E. Hoskins, and John W. Bagshaw. (Fish. Res. Bd. of Canada, Biol. Station, Nanaimo, British Columbia, Canada). 1969. ON THE STRUCTURE AND ENZYMATIC DEGRADATION OF THE EXTERNAL MEMBRANE OF THE SALMON EGG. Canad. J. Zool., 47(1): 146-148.

The radiate membrane ("capsule") of chum salmon (Oncorhynchus keta) eggs has integrated with it another, outermost, non-chitinous membrane which prevents the digestion of the radiate membrane by "hatching enzyme" of chum salmon or by pronase applied externally but not internally. Crude chum salmon hatching enzyme(s) has an optimum pH of 7.5-8.0 for the release of soluble peptides from the radiate membrane, requires metal ions for activity, and can also decompose the radiate membranes of coho salmon (Oncorhynchus kisutch) and steelhead (Salmo gairdneri) eggs. (Authors)

11449. Suppes, C., O. W. Tiemeier, and C. W. Deyoe. 1968. SEASONAL VARIATIONS OF FAT, PROTEIN, AND MOISTURE IN CHANNEL CATFISH. Trans. Kans. Acad. Sci., 70(3): 349-358.

The seasonal variations of fat, protein, and moisture of age class II channel catfish fed a pelleted diet were determined. Results suggested that fish fed supplemental diets deposited an average of 210 kilocalories as fat during a 132-day feeding period. The same amount of fat was lost during a starvation period of 244 days at a mean water temperature of 8.9 C. Fish starved at 21.1 C lost 393 kilocalories during the same period. For fish starved at 8.9 C, 70 percent of the energy for metabolism was supplied by fat stored in fish muscle. For fish starved at 21.1 C, 80 percent of their energy was obtained from fat and protein in fish muscle. (Authors)

11450. Tiemeier, O. W., and C. W. Deyoe. (Kansas State Univ., Manhattan, Kansas). 1968. GROWTH OBTAINED BY STOCKING VARIOUS SIZE COMBINATIONS OF CHANNEL CATFISH, (Ictalurus punctatus), AND EFFICIENCIES OF UTILIZING PELLETED FEED. The Southwestern Naturalist 13(2): 167-174.

When identical biomasses but different numbers of large and small age group II channel catfish were stocked in 2 polyethylene-lined ponds and fed pellets during spring and summer months, individual large fish grew consistently more than small fish but total gains of the more numerous small fish were greater. Difference in size of age group II fish appeared not to inhibit growth of the small fish. When 179 large fish were stocked in 2 ponds and 179 small fish in each of 2 ponds and fed at the same rate, large fish gained more weight than small fish. When 200 age group I and 50 age group III fish, with an initial difference in mean weight of 157.1 grams, were stocked together and given supplemental feed, a 1-gram difference in initial weight was associated with a final difference in weight gain of 1.9 grams. When 600 age group I fish were stocked with 50 age group III fish, growth of the large fish was similar to that achieved in other ponds but the final individual weight of age group I fish was approximately 50% less than at the lower stocking rate (200 fish). Rates of feed conversions, number of grams of protein and kilocalories required to produce a pound of gain were not as efficient as those obtained by stocking only group I fish. Competition under our experimental conditions appeared to be greater with increased numbers of fish rather than between fish of different sizes. (Authors)

11451. DeVries, Arthur L., and Donal E. Wahlschlag. 1969. FREEZING RESISTANCE IN SOME ANTARCTIC FISHES. Science, 163(3871): 1073-1075.

Measurements of serum freezing points in three Antarctic marine fishes indicated that they do not freeze in the −1.87°C seawater because their blood is isosmotic to seawater. Concentrations of sodium chloride, urea, and free amino acids in the serum accounted for only half of the freezing-point depression of the serum. A protein containing carbohydrate was isolated which accounted for 30 percent of the freezing-point depression of the serum. (Authors)

11452. Hopkins, C. L., S. R. B. Solly, and A. R. Ritchie. (Fish. Res. Div., Marine Dept., Wellington, New Zealand). 1969. DDT IN TROUT AND ITS POSSIBLE EFFECT ON REPRODUCTIVE POTENTIAL. N. Z. J. mar. Freshwat. Res., 3(2): 220-229.

Eggs of rainbow trout (Salmo gairdneri Richardson) from five different lakes in North Island, New Zealand, were reared to discover whether they showed significant differences in survival which could be linked with DDT levels in the tissue. The muscle and gonads of pre-breeding season fish and the parent females were assayed for DDT, as were the whole fry at the end of rearing. The highest DDT levels were found in fish from Lake Rerewhakaaitu, and eggs from these fish showed the least viability. Mortality was relatively low among eggs from fish out of the other lakes. Thus, DDT may possibly contribute to the high mortality found in eggs from Lake Rerewhakaaitu fish. (Authors summ.)

11453. Sparks, Richard E., John Cairns, Jr., and Frank B. Cross. (Zoology Dept., Univ. of Kansas, Lawrence, Kansas). 1969. SOME EFFECTS OF A NEUTRAL MIXTURE OF CALCIUM OXIDE AND SULFURIC ACID ON CHANNEL CATFISH Ictalurus punctatus (Rafinesque). Trans. Kans. Acad. Sci., 72(1): 1-15.

The Sunflower Army Ammunition Plant (S. A. A. P.), operated by the Hercules Powder Company at Sunflower, Johnson County, Kansas, discharges waste containing sulfuric acid neutralized with slaked line into Kill Creek, a tributary of the Kansas River. Channel catfish, Ictalurus punctatus (Rafinesque), are indigenous to both streams. Twelve channel catfish, kept in a synthetic waste approximating that of S. A. A. P., died within two days when a suspended solids concentration of 24, 200 - 30, 400 mg/l was maintained by vigorous aeration. Ten out of 15 channel catfish survived in synthetic waste for the 22-28 day duration of the experiments when a suspended solids concentration of 367-509 mg/l was maintained by moderate aeration. Eleven of 12 catfish survived 22-28 days in synthetic waste from which all settleable solids were removed, and 17 of 22 catfish kept in tapwater as controls survived 22-28 days. No significant mortality occurred among Notropis lutrensis, Notropis umbratilis, Lepomis cyanellus, Gambusia affinis, and Ictalurus melas kept in synthetic waste during preliminary tests. The findings of this study suggest that acid treatment plants should remove settleable solids from neutralized waste before it is discharged, thereby preventing at least one potential stress on some fish in receiving streams. (Authors)

11454. Semenova, L. M. 1968. SOME DATA ON THE BIOLOGY OF Bosmina coregoni Baird IN RYBINSK RESERVOIR. (Nekotorye dannye po biologii Bosmina coregoni Baird v Rybinskom vodokhranilishche). Biologiya i Troficheskie Svyazi Presnovodnykh Bespozvonochnykh i Ryb. Sbornik Statei. Akademiya Nauk SSSR, Institut Biologii Vnutrennikh Vod, Trudy, Nauka: Leningrad, 17(20): 21-26. Translated by Robert M. Howland. Division of Fishery Research, Bureau of Sport Fisheries and Wildlife, Washington, D. C.

B. Coregoni is encountered in several varieties in Rybinsk Reservoir: B. c. longispina, B. c. coregoni, B. c. gibbera, B. c. crassicornis, B. c. lilljeborgii. B. coregoni is primarily a pelagic species that is confined to the open areas of the reservoir and is found in all reaches. Seasonal changes in the abundance and biomass of Bosmina are considerable. There is a drop in the biomass of Bosmina in July-August. Laboratory tests revealed that optimal temperatures for B. c. longispina ranged between 16 and 22°. In July-August, the water temperature in the reservoir comprises 17-21°, i. e. close to optimal. This may indicate that the summer decline is not connected with temperature. -- Robert M. Howland.

11455. Agalides, Eugene. (Biophysical Communication Lab. Res. Dept., General Dynamics Electronics Div., Rochester, N. Y.). 1967. THE ELECTRICAL ACTIVITY OF THE FOREBRAIN OF SHARKS RECORDED WITH DEEP CHRONIC IMPLANTED ELECTRODES. Trans. N. Y. Acad. Sci., 29(4): 378-389.

11456. Matsuoka, Kisaku, and Yoshikazu Shiraishi. 1968. ECOLOGICAL STUDY ON THE RAINBOW TROUT STOCKED IN JIGOKU RIVER. Bull. Freshw. Fish. Res. Lab., Tokyo, 18(1): 1-12.

In order to develop a basic short-term stocking plan for rivers, seasonal change of growth rate, the condition factor, migration of fish to upstream or downstream regions, and rate of recapture, etc. were studied by the stocking of marked rainbow trout monthly in the Jigoku River by our laboratory, Tochigi Prefecture. There are several species of fish in the Jigoku River: Salmo gairdneri, Salmo trutta, Oncorhynchus rhodurus, Salvelinus fontinalis, Salvelinus pulvius, Tribolodon hakonensis, Rhinogobius brunneus and Cottus pollux, in which Salmo gairdneri is dominant. The growth rate of stocked fish is greatest in spring and least in winter. Generally speaking, the condition factor of the fish decreases after stocking and approaches that of native trout after two or three months. The condition factor is antagonistic to the growth rate seasonally; that is, the condition factor of the fish stocked in spring and summer is smaller than that in winter. The slender fish seems to be easier to catch by angling. The stocked rainbow trout have a tendency to remain at the point of stocking; then they migrate upstream. The recapture rate is higher for stocked fish in the summer and autumn when they migrate upstream. There is a hysteretic relation between catch amount per man-day and water temperature. (Authors)

11457. Ishida, Teruo, Taizo Miura, Yoshikazu Shiraishi, Syoiti Tanaka, and Minoru Tanaka. 1968. MESH SELECTIVITY OF GILL NETS FOR SOME FRESH-WATER FISHES. Bull. Freshw. Fish. Res. Lab., Tokyo, 18(1): 13-20.

11458. Kafuku, Takeichiro. 1968. STUDIES ON HYBRIDS BETWEEN CARP AND "KAWACHI" CRUCIAN CARP, I. MORPHOLOGICAL ANALYSIS ON F_1 HYBRIDS. Bull. Freshw. Fish. Res. Lab., Tokyo, 18(1): 21-40.

11459. Kafuku, Takeichiro, and Masahiro Matsushima. 1968. STUDIES ON HYBRIDS BETWEEN CARP AND "KAWACHI" CRUCIAN CARP II. SPAWNING OF F_1 RECIPROCAL CROSSED. Bull. Freshw. Fish. Res. Lab., Tokyo, 18(1): 41-48.

11460. Kawashima, Kazuo, and Ryo Suzuki. 1968. LEPIDOLOGICAL STUDY IN SOME JAPANESE SALMONS. Bull. Freshw. Fish. Res. Lab., Tokyo, 18(1): 49-59.

11461. Kawatsu, Hiroshi. 1968. STUDIES ON THE ANEMIA OF FISH - II. HEMORRHAGIC ANEMIA OF RAINBOW TROUT INDUCED BY REPEATED BLEEDINGS. Bull. Freshw. Fish. Res. Lab., Tokyo, 18(1): 61-66.

Hematological changes of anemia induced by repeated bleedings were observed in rainbow trout. The chronic hemorrhagic anemia of the rainbow trout was characteristic of hypochromic anemia: the increase of immature erythrocytes, the decrease of microcytic erythrocytes and the increase of erythrocyte size. The increase of erythrocyte size observed in this experiment must be distinguished from macrocytic anemia. Hyperchromic anemia was observed for a short period in the initial stage. Leucocytes increased markedly in the initial stage, and decreased to the initial levels in the chronic stage. (Auth. summ.)

11462. Satomi, Yoshihiro. 1968. SOME OBSERVATIONS ON THE LOSS OF CRUCIAN CARP FRY BY A WATER INSECT LARVA (Eretes sp.) AND ITS CONTROL WITH OXYETHYLENE DOCOSANOL. Bull. Freshw. Fish. Res. Lab., Tokyo, 18(1): 67-69.

11463. Track, N. S., R. J. Jarrett, and H. Keen. (Dept. of Medicine, Guy's Hospital Medical, London, S. E. 1, England). 1968. INSULIN BIOSYNTHESIS: STUDIES OF RIBONUCLEIC ACID METABOLISM in vitro IN ISOLATED SURVIVING MAMMALIAN AND FISH ISLETS. Proc. biochem. Soc., London, 109(3): 31-32.

11464. Somero, George N. (Dept. of Zoology, Univ. of British Columbia, Vancouver 8, British Columbia, Canada). 1969. ENZYMIC MECHANISMS OF TEMPERATURE COMPENSATION: IMMEDIATE AND EVOLUTIONARY EFFECTS OF TEMPERATURE ON ENZYMES OF AQUATIC POIKILOTHERMS. The American Naturalist, 103(933): pp. 517.

11465. Smith, R. J. F. (Dept. of Biology, Univ. of Saskatchewan, Saskatoon, Canada). 1969. CONTROL OF PRESPAWNING BEHAVIOUR OF SUNFISH (Lepomis gibbosus AND L. megalotis). I. GONADAL ANDROGEN. Animal Behaviour, 17(2): 279-285.

Gonadectomized male longear (Lepomis megalotis) and pumpkinseed (L. gibbosus) sunfish maintained high levels of aggression but failed to dig nests under conditions which induced nesting in sham-operated fish. The castrates dug nests when treated with methyl testosterone. Longears with gonads moved into shallow water more readily than did castrates and dug their nests closer together than did testosterone treated castrates. Male coloration was retained in castrates which were forced into close contact but not in castrates allowed to move freely in wading pools. Intact longears in wading pools retained their bright coloration, but were effectively crowded by the closeness of their nests. Nest digging and nest site location are controlled by gonadal androgens while aggression and coloration are unaffected by hormones in a crowded situation but are increased by androgens in an open situation, possibly due to the crowding caused by nesting in close groups.

11466. Hoffman, G. L., C. E. Dunbar, K. Wolf, and L. O. Zwillenberg. (Bureau of Sport Fisheries and Wildlife, Eastern Fish Disease Lab., Kearneysville, West Virginia 25430). 1969. EPITHELIOCYSTIS, A NEW INFECTIOUS DISEASE OF THE BLUEGILL (Lepomis macrochirus). Antonie van Leeuwenhoek, 35(2): 146-158.

A new infectious, benign and chronic disease, histopathologically distinct from the viral disease lymphocystis, has been found in the bluegill. The symptoms are much enlarged cells in skin and gill epithelium, filled with basophilic granules. By electron microscopy these granules were shown to be organisms with the morphological characteristics of Bedsonia (Miyagawanella). During an attempt to isolate the agent in the bluegill fibroblast cell line BF-2, a cytopathic effect somewhat resembling the lesions in vivo was found in the first passage. In later passages the agent was lost, but a true virus eliciting a distinctive fusiform cytopathic effect was recovered from these passages. The virus was found to be cytopathogenic also for the rainbow trout cell line RTG-2, but no recognizable disease could be evoked in young bluegills by inoculation of infected cell culture material. While the larger sized, non-viral organism is almost certainly the etiological agent of epitheliocystis, the role of the virus is, therefore, conjectural. Electron microscopy of thin sections has shown the virus to resemble influenza virus in morphology. (Authors)

11467. Amin, Omar M. (Virology Section, National Communicable Disease Center, Atlanta, Georgia 30333). 1969. HELMINTH FAUNA OF SUCKERS (Catostomidae) OF THE GILA RIVER SYSTEM, ARIZONA. II. FIVE PARASITES FROM Catostomus spp. Amer. Midl. Nat., Notre Dame, Ind., 82(2): 429-443.

Isoglaridacris hexacotyle (Linton, 1897) Mackiewicz, 1968, (Cestoda: Caryophyllaeidae), metacercariae of Clinostomum marginatum Rudolphi, 1819 (Trematoda: Clinostomidae) and Ornithodiplostomum ptychocheilus Faust, 1917 (Trematoda: Strigeidae), Neoechinorhynchus sp. Hamann, 1892 (Acanthocephala: Neoechinorhynchidae), and Illinobdella moorei Meyer, 1940 (Hirudinea: Piscicolidae) were recovered from Catostomus insignis and C. clarki from one or more of the following localities: Upper and Lower Verde and Salt rivers, tributaries of the Gila River. All but the first parasite are new host and locality records. Methods of fish capture and processing of worms, notes on the ecology and food habits of hosts, sites of infection, host-parasite interrelationships of the five parasites, and a morphological growth study of the first two are included. (Auth.)

11468. Fujii, Ryozo, and Ronald R. Novales (Dept. of Biological Sciences, Northwestern Univ., Evanston, Illinois 60201). 1969. CELLULAR ASPECTS OF THE CONTROL OF PHYSIOLOGICAL COLOR CHANGES IN FISHES. American Zoologist, 9(2): 453-463.

Recent advances in the cellular aspects of chromatophoric activities in fishes are reviewed, special emphasis being laid on the black pigment-containing cells, the melanophores. A few recent electron-microscopic studies have disclosed the fine structure of melanophores. They are enclosed with a single cell membrane, within which melanosomes and other cell organelles are found. All observations favor the view that melanosomes are selectively moved through the cellular processes, leaving the cell contour rather fixed. In regard to these findings, current ideas about the mechanisms of pigment movements are discussed. Particular attention is directed to the possible intervention of microtubules and the theory of migration of pigment by intracellular electrophoresis. The regulatory mechanisms of pigment cells are then dealt with. The adrenergic nature of transmission is affirmed in the peripheral melanin-aggregating nervous system. The mode of nervous supply to a melanophore is also analyzed. Investigations of the antagonistic, melanin-dispersing, nervous system are also considered, with special reference to recent physiological studies and to the finding of synaptic vesicles by electron microscopy. On the basis of these results, a new interpretation of the so-called Parker effect is proposed. (Authors)

11469. Bagnara, Joseph T., and Mac E. Hadley (Dept. of Biological Sciences, Univ. of Arizona, Tucson, Arizona 85721). 1969. THE CONTROL OF BRIGHT COLORED PIGMENT CELLS OF FISHES AND AMPHIBIANS. American Zoologist, 9(2): 465-478.

The bright colored pigment cells of fishes and amphibians include xanthophores, erythrophores, and iridophores. Their ultrastructure and pigmentary composition are discussed. The role of the hypophysis in controlling both physiological and morphological changes of color in both groups is discussed. The nervous system may be involved in physiological responses of fish iridophores. The physiology of the amphibian iridophore is discussed from the point of view of its parallelism of response to that of the melanophore. Intermedin causes iridophores to contract as do several drugs; the effect of intermedin can be reversed by still other agents. Melatonin has no effect on iridophores. Xanthophores of some fishes and amphibians are induced to expand by intermedin. The morphological effects of intermedin at the organellar level are presented in terms of ultrastructure and pigmentary composition. The integrated response of amphibian dermal chromatophores to intermedin is described as a basic mechanism for change in color. (Authors)

11470. Veger, J. 1967. TOXIC EFFECT OF THREE ORGANOPHOSPHATE INSECTICIDES ON THE FEMALES OF Lebistes reticulatus. Věst čsl. Spol. zool., 1967, 31, 88-95; Chem. Abstr., 1967, 67, 2991; Water Pollution Abstracts, 41(1): Abst. No. 169. 1968.

Results are given of experiments on the toxicity to female guppies (Lebistes reticulatus) of 3 commercial organophosphorus insecticides, namely fosfotion (containing 30 percent malathion), intration (containing 50 percent thiometon), and Soldep (containing 40 percent trichlorfon). The 48-hour TL_m values were found to be 9 mg per litre for fosfotion, 30 mg per litre for intration, and 100 mg per litre for Soldep. The symptoms of poisoning were typical of organophosphorus insecticides. Graphical results are also included showing the toxicity of the insecticides to Paramecium caudatum, Chironomus cyclops, and Euglena gracilis. (Auth.)

11471. Federal Water Pollution Control Administration and Vanderbilt University, Portland, Oregon. 1968. BIOLOGICAL ASPECTS OF THERMAL POLLUTION. Proc. of the National Symposium on Thermal Pollution, June 3-5, 1968. Vanderbilt Univ. Press, Nashville, Tennessee 37203, xx+407 p., 77 illus., Pr. $7.95.

11472. Gasaway, Charles R. (Oklahoma Fishery Res. Lab., Norman, Oklahoma). 1968. COMPARISON OF BASS-BLUEGILL AND BASS-REDEAR SUNFISH STOCKING IN OKLAHOMA FARM PONDS. Proc. Okla. Acad. Sci. Vol. 47: 397-406.

Thirty-eight ponds from ten counties in the state were sampled with a boom-type electric shocker and a minnow seine for the purpose of comparing the fish population structure of ponds stocked with largemouth bass and redear sunfish with those stocked with largemouth bass and bluegill. Over the past ten years, largemouth bass and redear have been stocked at an average ratio of 1.1:1, and bass and bluegill were stocked at an average ratio of 1.6:1. There was a tendency for the percent of the populations consisting of bass to decline as the ponds aged when stocked with the bass-redear sunfish combination, but this decline was not evident in the ponds stocked with the bass-bluegill combination. No other differences in the structure of the bass populations could be found between the two groups of ponds. Redear sunfish had reproduced during the spring of 1964 in only 31% of the ponds in which they had been stocked, while the bluegill had reproduced in 69% of the ponds in which they had been stocked. Channel catfish were found in 40% of the ponds in which they had been stocked and had reproduced during the spring of 1964 in 15% of them. Green sunfish were found in 80% of the ponds studied, and at least one species of sunfish not stocked was found in 85% of the ponds. A significant positive correlation was found between the catches per unit of effort of largemouth bass and bluegill, but no significant correlation between any of the other species was indicated. These studies indicate that in ponds stocked at an approximate 1:1 ratio of bluegill or redear sunfish to largemouth bass and in quantities of somewhat less than 75 fish of each species per acre, the bass-bluegill combination is capable of providing more satisfactory fish populations. (Auth. summ.)

11473. Aoe, Hiroshi, Isao Masuda, Takashi Saito, and Atuko Komo. 1967. WATER-SOLUBLE VITAMIN REQUIREMENTS OF CARP—I. REQUIREMENT FOR VITAMIN B_2. Bull. Jap. Soc. sci. Fish., 33(4): 355-360.

The deficiency symptoms and requirement of young carp for vitamin B_2 were studied using the basal diet devised by HALVER et al. The deficiency symptoms are characterized by anorexia, poor growth, high mortality and hemorrhages in both the epidermis and the hepatopancreas. These symptoms were alleviated by the administration of vitamin B_2. The requirement of young carp was found to be 0.11 mg per kg of body weight per day (0.40 mg per 100 g of diet) on the basis of body weight gain, and 0.17 mg per kg of body weight per day (0.62 mg per 100 g of diet) on the basis of storage levels of vitamin B_2 in the hepatopancreas. (Authors summ.)

11474. Ogino, Chinkichi. 1967. B VITAMINS REQUIREMENTS OF CARP—II. REQUIREMENTS FOR RIBOFLAVIN AND PANTOTHENIC ACID. Bull. Jap. Soc. sci. Fish., 33(4): 351-354.

Feeding trials were conducted to study the requirements and deficiency symptoms of young carp for riboflavin and pantothenic acid. The synthetic diet of HALVER et al., in which the levels of the test vitamins were varied respectively, was used throughout the experiments. The general feeding technique was reported in a previous paper. The growth responses of the carp to dietary levels of riboflavin or pantothenic acid and accumulation of these vitamins in the hepatopancreas were employed as criteria for nutritional adequacy. The requirements of the carp for riboflavin and calcium pantothenate thus determined by 6-week feeding trials, were 0.23 - 0.33 mg and 1.0 - 1.4 mg per kg of body weight per day respectively. Symptoms of deficiency of these two vitamins in the carp are indicated. The most prominent pathological findings were hemorrhage in various areas of the body in riboflavin deficiency, and extremely poor weight gain in pantothenic-acid deficiency. (Auth.)

11475. Metuzals, J., G. Ballintijn-De Vries, and G. P. Baerends (Dept. of Histology, Faculty of Medicine, University of Ottawa, Canada). 1968. THE CORRELATION OF HISTOLOGICAL CHANGES IN THE ADENOHYPOPHYSIS OF THE CICHLID FISH Aequidens portalegrensis (Hensel) WITH BEHAVIOUR CHANGES DURING THE REPRODUCTIVE CYCLE. I & II. Koninkl. Nederl. Akademie van Wetenschappen, Amsterdam. Reprinted from Proceedings, Series C, 71, No. 4, pp. 391-410.

The present study was undertaken as an approach to obtain insight into the functions (effects) and causation of the pre-spawning displays in substrate spawning Cichlid fishes. In five ethologically determined behavioural phases during the reproductive cycle, viz. two consecutive pre-spawning phases, actual spawning and two consecutive post-spawning phases, pituitaries of Aequidens portalegrensis were fixed and studied histo- and cytologically (not ultra-microscopically). Changes indicating production and discharge of FSH, LH and LTH were found to take place in the proximal pars distalis of the adenohypophysis during the pre-spawning phases in the β-cells (β_1 and β_2) and during the post-spawning phases in the α-cells. Possible interpretations of these changes are discussed. The findings justify further research on the causal relations (possibly in both ways) between the pre-spawning and post-spawning activities and the endocrine processes. (Authors summ.)

11476. Yoshida, Yoichi, Akira Kawai, and Masao Kimata. 1967. STUDIES ON MARINE NITRIFYING BACTERIA (NITRITE FORMERS AND NITRATE FORMERS)—IV. ON THE NITRITE FORMATION OF THE MARINE NITRITE FORMERS (2). Bull. Jap. Soc. sci. Fish., 33(4): 367-371.

11477. Yoshida, Yoichi. 1967. MICRODETERMINATIONS OF NITROGENOUS COMPOUNDS IN SEA WATER, USING MARINE BACTERIA—II. DETERMINATION OF NITRATE, USING A MARINE NITRATE REDUCING BACTERIUM. Bull. Jap. Soc. sci. Fish., 33(4): 348-350.

11478. Yoshida, Yoichi. 1967. MICRODETERMINATIONS OF NITROGENOUS COMPOUNDS IN SEA WATER, USING MARINE BACTERIA—I. DETERMINATION OF AMMONIA, USING A MARINE NITRIFYING BACTERIUM. Bull. Jap. Soc. sci. Fish., 33(4): 343-347.

11479. Volodin, V. M., and M. N. Ivanova. 1968. WAY OF LIFE, GROWTH AND FEEDING OF THE YOUNG BURBOT IN RYBINSK RESERVOIR. (Obraz zhizni, rost i pitanie molodi nalima v Rybinskom vodokhranilishche). Biologiya i Troficheskie Svyazi Presnovodnykh Bespozvonochnykh i Ryb. Sbornik Statei. Akademiya Nauk SSSR, Institut Biologii Vnutrennikh Vod, Trudy, Nauka: Leningrad, 17(20): 230-240. Translated by Robert M. Howland. Division of Fishery Research, Bureau of Sport Fisheries and Wildlife, Washington, D. C.

The young burbot leads a very secretive way of life. After hatching out, the larvae remain for some time in the spawning area, and then move off to the shallow littoral zone where they live together with the young of other species, but in contrast to the latter remain singly. At the end of the larval period the young burbot forsakes the littoral weeds, and the daily rhythm of its life becomes similar to that of adult individuals. Young-of-the-year burbot feed primarily on bottom invertebrates and toward the end of summer also on the young of other species of fish. Changeover to feeding on fish is not accomplished by all individuals simultan ously. Males begin to feed on fish first. As a result of this they fatten and grow more rapidly than females. Building of the digestive tract in the young is found to be in direct connection with their feeding peculiarities. The area of absorptive surface of the pyloric caeca in individuals which feed on mixed food is greater than in individuals which utilize only fish. Stormy weather during the early larval period of development and the death of young-of-the-year due to the drying up of shallow coves upon drop of the water level can exert a strong negative effect on the strength of replenishment. (Authors summ.)

11480. Mizelle, John D., and Delane C. Kritsky (Dept. of Life Sciences, Sacramento State College, Sacramento, California 95819). 1969. STUDIES ON MONOGENETIC TREMATODES. XL. NEW SPECIES FROM MARINE AND FRESHWATER FISHES. The American Midland Naturalist, Notre Dame, Ind., 82(2): 417-428.

This paper presents descriptions of new species as follows: Anacanthorus brevis from Brycon melanopterus (Cope); Dactylogyrus navarroensis from Hesperoleucas navarroensis Snyder; Diplectanum jaculator and D. toxotes from Toxotes jaculator (Pallas); Parahaliotrema affinis from Chaetodon auriga Forskal and C. lunula (Lacepede); P. brevis from Acanthostracion quadricornis (Linnaeus); P. cornutus from Bodianus pulchellus Poey; P. grandis from Chaetodon auriga, C. lunula and C. setifer Bloch; P. pacificus from Chaetodon nigrorostris (Gill); and P. zebrasoma from Zebrasoma veliferum (Bloch). (Authors)

11481. Kilambi, Raj V., and Raymond E. Baglin, Jr. (Dept. of Zoology, Univ. of Arkansas, Fayetteville, Arkansas 72701). 1969. FECUNDITY OF THE GIZZARD SHAD, Dorosoma cepedianum (Le Sueur), IN BEAVER AND BULL SHOALS RESERVOIRS. The American Midland Naturalist, Notre Dame, Ind., 82(2): 444-449.

A total of 82 gizzard shad (Dorosoma cepedianum) collected from Beaver and Bull Shoals Reservoirs, Arkansas, were used for fecundity estimates. The data were fitted by linear regression method in determining relationships between fecundity - total length, weight, and age of the shad. Fecundity estimations were employed as a means of differentiating spawning populations within and among the two reservoirs. (Authors)

11482. Berg, Andre (Biology Div., EURATOM Joint Res. Center, Ispra, Italy). 1968. STUDIES ON THE METABOLISM OF CALCIUM AND STRONTIUM IN FRESHWATER FISH. I. - RELATIVE CONTRIBUTION OF DIRECT AND INTESTINAL ABSORPTION. Mem. Ist. Ital. Idrobiol., Vol. 23: 161-196.

Using Sr^{85} as a tracer added to water or to food, the exchange rates and the contribution of direct exchange in total exchange can be estimated separately for Ca and for Sr, under a wide range of experimental conditions. (Auth.)

11483. Saila, S. B. (Marine Experiment Station, Univ. of Rhode Island, Kingston, Rhode Island 02881). 1969. SOME APPLICATIONS OF OBSERVATIONS AND EXPERIMENTS ON FISH BEHAVIOR IN DESIGNING FISHING GEAR AND DEVISING TACTICS, WITH SUGGESTIONS FOR FUTURE STUDIES. Proc. of the FAO Conf. on fish behavior in relation to fishing techniques and tactics, Bergen, Norway, October 19-27, 1967. FAO Fisheries Reports, 62(2): 49-58.

A brief review of some of the more recent literature on observations and experiments on fish behavior in relation to fishing gear and tactics is given. Some suggestions are made for considering fishing tactics as a problem in systems analysis. A conceptual scheme for a generalized fishery is presented. (Auth.)

11484. Nakamura, E. L. (U. S. Bur. of Comm. Fisheries Biol. Lab., Honolulu, Hawaii 96812). 1969. A REVIEW OF FIELD OBSERVATIONS ON TUNA BEHAVIOR. Proc. of the FAO Conf. on fish behavior in relation to fishing techniques and tactics, Bergen, Norway, October 19-27, 1967. FAO Fisheries Reports, 62(2): 59-68.

Observations of tuna behavior are reviewed for feeding, schooling, sounding in relation to the thermocline, associations with other organisms and objects, swimming speeds, attraction to surface disturbances, and repulsion by sound and light. Most of the observations were made in the pole-and-line, trolling, longline, and purse seine fisheries for tuna. (Auth.)

11485. Wolf, Ken (Eastern Fish Disease Laboratory, Leetown (P. O. Kearneysville) West Virginia 25430). 1968. LYMPHOCYSTIS DISEASE OF FISH. Bureau of Sport Fisheries and Wildlife Fish Disease Leaflet 13. 4 p. (Formerly Fishery Leaflet 565 of January 1964).

11486. Blaxter, J. H. S. (Natural History Dept. Univ. of Aberdeen, Aberdeen, Scotland). 1969. SWIMMING SPEEDS OF FISH. Proc. of the FAO Conf. on fish behavior in relation to fishing techniques and tactics, Bergen, Norway, October 19-27, 1967. FAO Fisheries Reports, 62(2): 69-100.

Apparatus for measuring swimming speeds of fish are described and their limitations discussed. Burst speeds, maintained for a few seconds, are listed and related to body length. Only salmonids, scombroids and some freshwater and a few marine species seem capable of burst speeds equivalent to 10 body lengths (B. L) per second or more. Endurance speeds, maintained for minutes, are also listed and, in general, lie between 2 and 3 B.L./sthough salmonids and clupeids can probably maintain 4 B. L./s or more. It may be that burst speeds, which are more a function of white muscle, are sacrificed in some species for improved endurance or stamina, a function of red muscle. While there are considerable temperature effects on endurance, burst speeds are much more independent of temperature. The biochemical background to activity, endurance and fatigue is discussed, showing how quite short periods of activity may lead to long-lasting biochemical effects in the blood and muscles, very intense activity perhaps raising the concentration of metabolites to a lethal level. The hydrodynamics of fish in relation to drag and swimming performance are mentioned with respect to the power available in fish muscle. Swimming performance is briefly related to the possible situations fish may meet in reacting to moving fishing gear. (Auth.)

11487. Mohr, H. (Institut für Fangtechnik Bundesforschungsanstalt für Fischerei, Hamburg, Germany). 1969. DETECTION OF FISH AND OBSERVATION OF FISH BEHAVIOR BY ECHO ANALYSIS AND PASSIVE LISTENING. Proc. of the FAO Conf. on fish behavior in relation to fishing techniques and tactics, Bergen, Norway, October 19-27, 1967. FAO Fisheries Reports, 62(2): 101-113.

Reasons for the need of behavior studies in modern fishing, especially concerning pelagic species, are given. Possibilities, advantages and disadvantages of acoustic means, compared with other observation methods, are discussed. The general characteristics of echo sounding and sonar are given and the types of acoustic devices used in fisheries and fishery research are described with special reference to sonar and the netsonde. Examples of the use of sounding devices for identification of fish species and behavior observations are discussed. Also, the effect of ultrasonic energy on fish is discussed. Lastly, the applicability of passive listening for fish detection and behavior studies is described. (Auth.)

11488. Cushing, D. H. (Fisheries Lab., Lowestoft, U.K.). 1969. THE USE OF ECHO SOUNDERS AND SCANNERS IN THE STUDY OF FISH BEHAVIOUR. Proc. of the FAO Conf. on fish behaviour in relation to fishing techniques and tactics, Bergen, Norway, October 19-27, 1967. FAO Fisheries Reports, 62(2): 115-130.

Methods of interpretation of information obtained by echo sounders and scanners to yield reliable criteria for study of fish behaviour are discussed. To overcome limitations of echo sounding in fish behaviour studies, a statistical basis for analyzing echo sounding observations is described. Also, the importance of relating exact laboratory experiments with extensive observations at sea is stressed. (Auth.)

11489. Margetts, A. R. (Fisheries Lab., Lowestoft, U.K.). 1969. COMPARATIVE AND EXPERIMENTAL FISHING AS METHODS FOR STUDYING FISH BEHAVIOUR IN THE NATURAL ENVIRONMENT. Proc. of the FAO Conf. on fish behaviour in relation to fishing techniques and tactics, Bergen, Norway, October 19-27, 1967. FAO Fisheries Reports, 62(2): 131-138.

Advantages and limitations of both comparative and experimental fishing as methods for studying fish behaviour are discussed. It is emphasized that these methods are limited largely to determining what changes occur in catch composition as a result of gear modification, and that other techniques are usually necessary for establishing why they occur. (Auth.)

11490. de Groot, S. J. (Netherlands Institute for Fishery Investigations, IJmuiden, Netherlands). 1969. A REVIEW PAPER ON THE BEHAVIOUR OF FLATFISHES. Proc. of the FAO Conf. on fish behaviour in relation to fishing techniques and tactics, Bergen, Norway, October 19-27, 1967. FAO Fisheries Reports, 62(2): 139-167.

Data are given concerning the behaviour of both commercial and non-commercial species of flatfish. Behaviour characteristics are reviewed and discussed under various categories including feeding havits, diel activity, nature and method of locomotion, vertical migration, spawning, and response to various stimuli. (Auth.)

11491. Von Brandt, A. (Institut für Fangtechnik, Bundesforschungsanstalt für Fischerei, Hamburg, Federal Republic of Germany). 1969. APPLICATION OF OBSERVATIONS ON FISH BEHAVIOUR FOR FISHING METHODS AND GEAR CONSTRUCTION. Proc. of the FAO Conf. on fish behaviour in relation to fishing techniques and tactics, Bergen, Norway, October 19-27, 1967. FAO Fisheries Reports, 62(2): 169-191.

The knowledge of fish behaviour by practical observation and experience often results in the development of very specific fishing methods and influences the design of fishing gear. Examples given here show how the habitat and behaviour of fish can influence fishing operations such as attracting, frightening etc. Also some examples show how far fish behaviour can influence the selection of material and netting, as well as the construction of guiding implements and non-return devices. Synthetic fibres for fishing gear made the consideration of fish behaviour much more important than it was in the days of natural fibres. (Auth.)

11492. Sasaki, T. (Tokyo Univ. of Fisheries, Tokyo, Japan). 1969. METHODS AND TECHNIQUES FOR STUDYING FISH BEHAVIOUR IN THEIR NATURAL ENVIRONMENT. Proc. of the FAO Conf. on fish behaviour in relation to fishing techniques and tactics, Bergen, Norway, October 19-27, 1967. FAO Fisheries Reports, 62(2): 193-200.

Various methods and techniques for studying fish behaviour in their natural environment are reviewed. Examples are given of aqualung surveys of artificial fishing reefs, special applications of underwater television and observations from submarines and other submersibles. The bathysphere, KUROSHIO, and a proposed new Japanese research submarine are described. (Auth.)

11493. Saetersdal, G. (Fishery Officer, Dept. of Fisheries, FAO, Rome, Italy). 1969. REVIEW OF INFORMATION ON THE BEHAVIOUR OF GADOID FISH. Proc. of the FAO Conf. on fish behaviour in relation to fishing techniques and tactics, Bergen, Norway, October 19-27, 1967. FAO Fisheries Reports, 62(2): 201-215.

The available information on the behaviour of gadoid fish of greatest commercial importance: cod, haddock, coalfish, hake and whiting is reviewed. Both patterns of general behaviour: migrations, vertical movements, schooling, feeding, and spawning behaviour, as well as reactions to fishing gear and tactics are covered. Considerable information is at hand on distribution and horizontal and vertical migrations, but less on schooling, feeding and spawning behaviour. As regards reactions to fishing gear, evidence of response to visual, mechanical and chemical stimuli are discussed. (Auth.)

11494. Shaw, E. (American Museum of Natural History, Dept. of Animal Behaviour, New York, N. Y.). 1969. SOME NEW THOUGHTS ON THE SCHOOLING OF FISHES. Proc. of the FAO Conf. on fish behaviour in relation to fishing techniques and tactics, Bergen, Norway, October 19-27, 1967. FAO Fisheries Reports, 62(2): 217-231.

The review discusses the problem of defining a school. Spatial arrangements of fish within a school and methods of measuring school structure are discussed. Some new studies on sensory components as related to parallel orientation, communications and advantages of living in a school are put forward. (Auth.)

11495. Parrish, B. B. (Dept. of Agriculture and Fisheries for Scotland, Marine Lab., Torry, Aberdeen, Scotland). 1969. A REVIEW OF SOME EXPERIMENTAL STUDIES OF FISH REACTIONS TO STATIONARY AND MOVING OBJECTS OF RELEVANCE TO FISH CAPTURE PROCESSES. Proc. of the FAO Conf. on fish behaviour in relation to fishing techniques and tactics, Bergen, Norway, October 19-27, 1967. FAO Fisheries Reports, 62(2): 233-245.

This contribution reviews the results of work done in tanks and in the field on the behavioural responses of fish to stationary and moving objects, of relevance to fish capture processes. Reference is made particularly to the differences in the responses of the fish to such objects and fishing gears in daylight and darkness and the relative importance of visual and non-visual stimuli is discussed. (Auth.)

11496. Enger, P. S. (Institute of Physiology, Univ. of Oslo, Oslo, Norway). 1969. SOUND RECEPTION IN TELEOST FISHES IN RELATION TO THE SOUND SOURCE DISTANCE. Proc. of the FAO Conf. on fish behaviour in relation to fishing techniques and tactics, Bergen, Norway, October 19-27, 1967. FAO Fisheries Reports, 62(2): 247-252.

Particle displacement is not determined by the signal strength of the source and the distance from it according to a simple inverse square law. There is a so-called acoustic near-field the size of which is frequency dependent. The variation of auditory thresholds of fish must be considered in relation to the extent of this acoustic near-field. The near-field effect is negligible beyond one wavelength. Experiments have shown that the existence of a swimbladder is essential for hearing by fish beyond the acoustic near-field. The noise from fishing vessels and gear can probably be detected at a considerable distance by fish with swimbladders. In the acoustic near-field the lateral line acts as a receptor so that even fish without a swimbladder are sensitive to sonic and infrasonic sounds of long wavelength. (Auth.)

11497. High, W. L. (Bur. of Comm. Fish., Exploratory Fishing and Gear Res. Base, Seattle, Washington). 1969. SCUBA DIVING, A VALUABLE TOOL FOR INVESTIGATING THE BEHAVIOR OF FISH WITHIN THE INFLUENCE OF FISHING GEAR. Proc. of the FAO Conf. on fish behaviour in relation to fishing techniques and tactics, Bergen, Norway, October 19-27, 1967. FAO Fisheries Reports, 62(2): 253-267.

The use of scuba diving methods in the study and documentation of trawl and fish behavior are discussed. Numerous underwater observations of flatfish, roundfish, and other marine animals within the influence of capturing gear have been made. Some limitations and potential hazards pertinent to the use of scuba diving near trawls are discussed. (Auth.)

11498. Zupanovic, S. (Institute of Oceanography and Fisheries, Split, Yugoslavia). 1969. STUDY OF SARDINE (Sardina pilchardus Walb.) BEHAVIOR IN THEIR NATURAL ENVIRONMENT BY ECHO SOUNDER AND ENVIRONMENTAL FACTORS. Proc. of the FAO Conf. on fish behaviour in relation to fishing techniques and tactics, Bergen, Norway, October 19-27, 1967. FAO Fisheries Reports, 62(2): 269-281.

The author analyzes the behavior of sardines by means of the echo sounder in relation to environmental factors (light, feeding and temperature). In 1962 the sardine remained at a depth of 40 to 60 m (sometimes even deeper) by day, and migrated upwards (20 to 30 m) at dusk and at night. The schools were mostly compact by day and scattered at night, which was probably influenced by changes in the underwater illumination. Diurnal vertical migrations of sardines were greater when the thermocline in summer was less steep. It was observed during the fishing season that sardines migrated upwards through thermoclines of 0.6 to 2.5°C in about 5 to 10 m, but declined to move upwards or downwards through thermoclines of 4.5 to 6°C in about 2 to 5 m. (Auth.)

11499. Kurc, G. (Institut scientifique et technique des pêches maritimes, 75 - Paris 16ème, France). 1969. PHOTOTROPIC REACTIONS APPLIED TO FISHING. Proc. of the FAO Conf. on fish behaviour in relation to fishing techniques and tactics, Bergen, Norway, October 19-27, 1967. FAO Fisheries Reports, 62(2): 283-296.

The use of artificial light as an attractant is an improvement on traditional fishing methods using bait. However, little is known as to what induces fish to move toward a light source and stay there. An examination of the different theories attempting to explain phototropism in fish is followed by a discussion of the findings of observations on fish under conditions at sea. An understanding of the behavior of animals in a light field, such behavior being governed by a number of biological and abiotic factors, suggests improvements of light-fishing gear and in these techniques which have been used since ancient times. The outlook for the combined use of light, fish pumps and electric power are also discussed. (Auth.)

11500. Dowd, R. G. (Fish. Res. Bd. of Canada, Bedford Inst. of Oceanography, Dartmouth, Nova Scotia, Canada). 1969. AN ECHO COUNTING SYSTEM FOR DEMERSAL FISHES. Proc. of the FAO Conf. on fish behaviour in relation to fishing techniques and tactics, Bergen, Norway, October 19-27, 1967. FAO Fisheries Reports, 62(2): 315-321.

A digital data acquisition system for direct counting of echoes from demersal fish containing swimbladders is described. The promising results obtained in initial field tests suggest the system will have application as an effective research tool in population studies. (Auth.)

11501. Stickney, A. P. (Bur. of Comm. Fish. Biol. Lab., Boothbay Harbor, Maine). 1969. ORIENTATION OF JUVENILE ATLANTIC HERRING (Clupea harengus harengus L.) TO TEMPERATURE AND SALINITY. Proc. of the FAO Conf. on fish behaviour in relation to fishing techniques and tactics, Bergen, Norway, October 19-27, 1967. FAO Fisheries Reports, 62(2): 323-342.

Laboratory experiments were conducted on the temperature and salinity preferences of juvenile herring. Prior adaptation to different temperatures produced significant but transient changes in the temperature preference. A final temperature preferendum of 12°C was established. At low temperature (below 10°C) salinities above 29 o/oo were preferred. The response to salinity at temperatures above 10° was not consistent, and appeared to vary seasonally. (Auth.)

11502. Rollefsen, G. (Institute of Marine Research, Bergen, Norway). 1969. BIG EVENTS ON A SMALL SCALE. Proc. of the FAO Conf. on fish behaviour in relation to fishing techniques and tactics, Bergen, Norway, October 19-27, 1967. FAO Fisheries Reports, 62(2): 357-360.

The behaviour pattern of newly hatched fish larvae until it takes its first meal from the sea is described. Whether the larvae do this by instinct or by learning by trial is discussed in relation to their survival. (Auth.)

11503. Verheijen, F. J. (Laboratorium voor Vergelijkende Fysiologie, Jan van Galenstraat 40, Utrecht, Netherlands). 1969. SOME ASPECTS OF THE REACTIVITY OF FISH TO VISUAL STIMULI IN THE NATURAL AND IN A CONTROLLED ENVIRONMENT. Proc. of the FAO Conf. on fish behaviour in relation to fishing techniques and tactics, Bergen, Norway, October 19-27, 1967. FAO Fisheries Reports, 62(2): 417-429.

Several behaviour patterns of fish that are of interest to fishing gear and tactics depend, at least in part, on vision. Recent data about the hierarchical ways in which sensory information is processed in the neural structures and then leads to behaviour, indicate that we run the risk of overestimating the level of integration and thus of misinterpreting the biological consequences of the activities an animal shows under simplified artificial stimulus conditions. With regard to vision, it seems essential to take into full account the recent findings about the

angular radiance distribution in the fish habitat. This seems of importance with regard to the neural processing of visual information. Examples are given of the reactions of fish under simplified visual stimulus conditions. (Auth.)

11504. Olsen, K. (Institute of Marine Research, Bergen, Norway). 1969. A COMPARISON OF ACOUSTIC THRESHOLD IN COD WITH RECORDINGS OF SHIP-NOISE. Proc. of the FAO Conf. on fish behaviour in relation to fishing techniques and tactics, Bergen, Norway, October 19-27, 1967. FAO Fisheries Reports, 62(2): 431-438.

Acoustic threshold levels have been obtained for cod in conditioning experiments. Frequency response for pure tone signals are maintained in a frequency range of 50 to 540 hz. The thresholds vary with frequency of stimulus and distance between fish and sound source, from -7dB to +25dB related to 1 μbar. Comparison of the threshold levels with the noise levels generated by two research vessels shows that ship noises would be perceived by cod at distances up to at least 70 to 80 m. The possibility of directional hearing in cod is also discussed and verified by experiment. (Auth.)

11505. Magnuson, J. J. (U. S. Bur. of Comm Fish. Biol. Lab., Honolulu). 1969. SWIMMING ACTIVITY OF THE SCOMBRID FISH Euthynnus affinis AS RELATED TO SEARCH FOR FOOD. Proc. of the FAO Conf. on fish behaviour in relation to fishing techniques and tactics, Bergen, Norway, October 19-27, 1967. FAO Fisheries Reports, 62(2): 439-451.

The relation between swimming activity and food search was evaluated from the effects of time of day and food deprivation on typical swimming speeds and on responsiveness to food. Euthynnus affinis (35 to 42 cm fork length) were studied in outdoor tanks (7.3 m diameter, 1.1 m deep) that were illuminated at night (0.05 to 0.46 lux at the surface) so that the fish could avoid swimming into the walls. When sharing the tank with smaller live forage fish, E. affinis fed on these prey only during daylight. Likewise, their responsiveness to introduced food flavour at two deprivation levels, measured as increases in swimming speed, was greater during daylight (32 and 50 cm/sec) than at night(2 and 6 cm/sec). Responsiveness to food flavour also increased with duration of food deprivation. When food flavour was introduced to fish deprived of food for 2 to 5 h, swimming speed increased by 43 cm/sec whereas speed of fish deprived for 42 to 115 h increased by 119 cm/sec. In contrast, typical swimming speeds in the absence of food or food stimuli had no marked diel periodicity and did not increase with food deprivation. Recently captured fish swam continuously during daylight (80 cm/sec) and during the night (83 cm/sec). Speed declined by 20 percent in the first 24 h of food deprivation and 33 percent in the first 96 h of deprivation. Consequently, the amount of ocean searched by E. affinis would not be varied by changes in typical speed, but rather by changes in responsiveness to food. Typical swimming speeds must bring E. affinis in contact with sufficient food during daylight; but the speed is apparently regulated by biological requirements other than food search, perhaps hydrostatic equilibrium and gill ventilation. (Auth.)

11506. Hamashima, K., I. Mori, and Y. Kuwano (Nagasaki Prefectural Fisheries Experimental Station, Nagasaki, Japan). 1969. SOME OBSERVATIONS ON FISH SCHOOLS AND THEIR ENVIRONMENT. Proc. of the FAO Conf. on fish behaviour in relation to fishing techniques and tactics, Bergen, Norway, October 19-27, 1967. FAO Fisheries Reports, 62(2): 453-461.

Fishes are believed to form schools in the presence of shelters, when attracted by food, or, during the breeding season. This paper describes some observations made on the factors inducing the formation of fish schools in coastal fishing grounds. It has been found that topographical conditions and the position of water masses are related to the formation of schools and the direction and force of tidal currents influence their position. (Authors)

11507. Overstreet, Robin M. (Institute of Marine Sciences, Univ. of Miami, Miami, Florida). 1969. DIGENETIC TREMATODES OF MARINE TELEOST FISHES FROM BISCAYNE BAY, FLORIDA. Tulane Studies in Zoology and Botany, 15(4): 119-176.

This study includes 111 species of Digenea from 69 of 113 species of teleost fishes examined from Biscayne Bay, Florida. Biscayne Bay represents the reported northern limit along the Atlantic coast for all but 22 of the 111 species. It represents the southern limit for only one Didymocystis scomberomori. From the known collections reported in the literature, the Digenea from Biscayne Bay appear to consist primarily of a tropical fauna. Species previously known from the Pacific Ocean only are Botulisaccus pisceus and Pseudocreadium scaphosomum. There are 81 new host records. (Auth.)

11508. Halver, J. E., L. M. Ashley, and R. R. Smith (Western Fish Nutrition Lab., U. S. Fish and Wildlife Serv., Cook Washington). 1969. AFLATOXICOSIS IN COHO SALMON. Nat. Cancer Inst. Monogr. 31: 141-155.

Young coho salmon, force-fed aflatoxin B_1 at 5, 10, or 15 mg toxin/kg body weight in 5 or 10 consecutive daily doses, developed toxic liver damage within 10 days post intubation when held in 15°C water. Acute hemorrhagic liver necrosis and subsequent mortality only occurred after ingestion of 8-10 mg of aflatoxin B_1/kg body weight over at least a 5-day period. Histology revealed areas of hepatocyte regenerative hyperplasia at each level of toxin tested. Rainbow trout of the same size given 0.5 mg aflatoxin B_1/kg body weight/day for 5 days all died by Day 11 and showed massive hemorrhagic liver necrosis, bloody ascites, and other physiological organ toxicosis. Comparative bioassay with trout and coho salmon fed aflatoxin B_1 at 20 μg/kg dry complete test diet daily for 20 months in 15°C water showed no tumors in salmon and typical hepatoma in all surviving trout. Coho salmon were 10-30 times more resistant to aflatoxicosis than rainbow trout and were generally refractory to chronic dietary treatment designed to induce hepatoma. (Authors)

11509. Engstrom-Heg, Robert (New York Bur. of Fish Lab., Livingston Manor, New York). 1968. DIET AND GROWTH OF JUVENILE SALMON IN AN ESTUARIAL IMPOUNDMENT. Wash. Dept. Fish., Fish. Res. Pap. 3(1): 5-26.

In May 1955, 1,043,000 marked chinook salmon (Oncorhynchus tshawytscha) fingerlings were released in a shallow, 333-acre fresh-water impoundment formed by construction of a dam and tide-gate across the formerly brackish estuary of a small river. Limnological features, flora, and fauna (fresh-water with a few marine relicts) of the impoundment are described. Growth of salmon was near maximal for the species, average weight per fish increasing from 3.0 grams in May to 71.8 grams in September. About 95% of the diet of these fish consisted of the midge Chironomus tentans, consumed mainly during this insect's floating pupal stage, which was available as an abundant food item from early May to mid-October. Maximum standing crop of last-instar C. tentans larvae in the lake bottom was estimated at 159 pounds per acre. This food source was also utilized by about 160,000 chinook salmon fingerlings of wild origin, by smaller numbers of coho salmon fingerlings, cutthroat and steelhead trout, course-scaled suckers, sculpins, and a scattering of other species. Juvenile chum salmon evidently did not consume this large midge. Two accidental sea-water intrusions affected the midge population and probably the seaward migration pattern of the salmon. Experiments showed that 6 days exposure to 16°/oo sea water was lethal to C. tentans larvae. Bottom samples indicated some survival from shorter sea water exposures. C. tentans production is dependent to an unknown extent upon river-transported nutrients, including organic industrial wastes. Since C. tentans winters over as a mud-burrowing larva, and since other potential food sources are scarce throughout much of the year, successful management of this or similar impoundments as salmon rearing grounds must be geared to the life cycle and ecological requirements of this key food species. (Auth.)

11510. Jewell, Earle D. (Wash. Dept. Fish., Olympia, Wash.). 1968. SCUBA DIVING OBSERVATIONS ON LINGCOD SPAWNING AT A SEATTLE BREAKWATER. Wash. Dept. Fish., Fish. Res. Pap. 3(1): 27-36.

Scuba divers were utilized to study the lingcod of Shilshole Breakwater during the winter spawning period of 1960-61. Spawning commenced near mid-December and continued until early February. The nests had mostly hatched by mid-March. The guardian male lingcod appears to play an important function in protecting the egg mass from predation. Hatching averaged 42 days for early nests (late December) to 59 days for late nests (late January). A closure to the taking of lingcod by underwater spear fishermen from mid-December until mid-March appears to be desirable. Green sea urchins, dusky perch, and possibly cabezon were identified as predators on lingcod eggs. A method of tagging fish underwater by Scuba divers was developed and tested. (Auth.)

11511. DiDonato, Gene (Wash. Dept. Fish., Seattle, Wash.). 1968. THE WASHINGTON TROLL PINK SALMON (Oncorhynchus gorbuscha) FISHERY THROUGH 1965. Wash. Dept. Fish., Fish. Res. Pap. 3(1): 37-46.

Pink salmon have contributed significantly to the Washington troll salmon landings since the early 1950's. Major catches occur only in the odd-numbered years in a relatively limited coastal area adjacent to the entrance of Juan de Fuca Strait indicating a harvest almost exclusively on stocks destined for rivers of southern British Columbia and Puget Sound, Washington. The 50-day period of July 11 to August 31 comprises the peak of the fishery in which an average of 87.2% of the total troll catch occurs. Pink salmon are harvested near their maximum size which differs substantially from the pattern for chinook and coho. All three species are landed between June 15 and September 20 by both day and trip boats and the ability to fish selectively for coho or pink salmon within this time period appears difficult. The relatively limited time pink salmon are in the fishery, however, may provide some basis for future regulation. The increased harvest of pink salmon by troll gear has not resulted in a corresponding increase in the total commercial catch. As a result, trolling gear has accounted for a generally increasing percentage of the total Washington landings, reaching 14.4% in 1965. (Auth.)

11512. Senn, Harry G., and R. E. Noble (Wash. Dept. Fish, Olympia, Wash.). 1968. CONTRIBUTION OF COHO SALMON (Oncorhynchus kisutch) FROM A COLUMBIA RIVER WATERSHED HATCHERY. Wash. Dept. Fish., Fish. Res. Pap. 3(1): 51-62.

The harvest and escapement of three marked lots of 1961-brook hatchery reared coho (Oncorhynchus kisutch) are estimated from a Columbia River salmon hatchery. Harvest encompassed an area from Vancouver Island, British Columbia to Monterey, California. Contributions to all fisheries ranged between 1.3% and 5.1% of releases, with 56% of the catch taken by the troll fishery, 28% by the sport fishery, and 13% by the gill-net fishery. Three fish were taken in the fishery for every one returning to the hatchery. A minimal benefit-cost ratio was established at 2.5:1. (Authors)

11513. Bergman, Peter K., K. B. Jefferts, Hugh F. Fiscus, and Robert C. Hager. (Wash. Dept. Fish., Olympia, Wash.). 1968. A PRELIMINARY EVALUATION OF AN IMPLANTED, CODED WIRE FISH TAG. Wash. Dept. Fish., Fish. Res. Pap. 3(1): 63-84.

Small wire tage (1 x 1/4 mm) were implanted in pond-held chinook salmon fingerlings to determine their permanence and their effects on growth and mortality. Generally, the tags did not cause death. Handling harmed fish from a group that had high pre-experimental mortality, but did not affect fish with low pre-experimental mortality. The tags did not measurably affect growth rates. Several thousand chinook that were tagged and held in ponds lost tags only during the first month following tagging; the loss was 0.31% with head tags and 0.07% with back tags. Individual tags in particular tissues were observed with X-ray.

Tags were lost only when placed in the integument. Although some tags moved when implanted in muscle and other tissues, tags in cartilage remained stationary. While histological examination indicated that interactions between tissues and tags were generally not deleterious, back tags induced fibrous tissue growth. Current tagging methods are discussed, including preliminary trials of an injector that applies tags at an average rate of 700 per hour and a detector apparently adequate for goals of the study. A field test was initiated in two phases: (1) a release of yearling coho from a hatchery, and (2) the stocking of several lakes to observe tag effects during early life history. Results are not analyzed, but severe tag loss occurred. (Authors)

11514. DiDonato, Gene (Wash. Dept. Fish., Seattle, Wash.). 1968. THE INCIDENCE OF MOUTH INJURIES ON PACIFIC SALMON (GENUS Oncorhynchus) IN WASHINGTON. Wash. Dept. Fish., Fish. Res. Pap. 3(1): 85-92.

Sampling of adult sockeye and chum salmon in Puget Sound demonstrated a very low incidence (0.1%) of mouth injury. Scarred chinook salmon were found throughout the season in the Washington coastal and Puget Sound fisheries and the incidence of mouth injuries generally ranged between 2% and 6%. Coho salmon were also checked and scarring rates ranged from less than 1% to 11.5%. A significant positive relationship between time and scarring incidence was observed for coho. Observations of returning adult chinook and coho at various artificial production sites indicated that the incidence of scarring varied widely between river systems and that it was generally greater in fresh-water samples than in marine samples. Based on the virtual absence of scarring on sockeye and chum salmon and the observed occurrence on pink, chinook, and coho, it is concluded that the commercial troll and sport fisheries are responsible for the mouth injuries observed on the latter three species. A special sample of coho revealed injuries only in the interior of the mouth with no visible external sign. Severity of the mouth injury varied widely with the maxillary being the most common injury location. Since this bone is often clipped in combination with finmarking, distinguishing between an intentionally clipped maxillary and one damaged by hook and line gear is difficult. A direct relationship between scarring incidence and fishing intensity was discounted due to many variables such as size of the fish, size limits, hooking gear, etc. which may affect the incidence of scarring. (Auth.)

11515. Mathews, Stephen B., and Henry O. Wendler. (Wash. Dept. Fish., Olympia, Wash.). 1968. ECONOMIC CRITERIA FOR DIVISION OF CATCH BETWEEN SPORT AND COMMERCIAL FISHERIES WITH SPECIAL REFERENCE TO COLUMBIA RIVER CHINOOK SALMON. Wash. Dept. Fish., Fish. Res. Pap. 3(1): 95-105.

Fishery managers are often faced with the problem of promoting division of a physically limited resource between commercial and recreational users. In some cases one or the other user is capable of taking all of the available harvest. The meaning and measurement of net economic yield for both user groups is discussed and a simulated demand curve for sport fisheries at different levels of angler success is presented. Mathematical models of the 1965 spring and fall chinook fisheries of the Columbia River showing comparative coefficients of catchability are shown. A spring chinook on the average had about five times the chance of being caught as a fall chinook by any particular unit of sport fishing effort. On the basis of the size of these two chinook runs in 1965 it would be 20 years for the spring run and 47 years for the fall run before the sport fishery alone is capable of taking the available harvest. Based on economic criteria presented and considering net yields from the fisheries, there would be an overall net gain from eliminating the spring chinook commercial season, but a substantial loss from eliminating the fall season. (Authors)

11516. Putz, R. E., and J. T. Bowen. 1968. THE ANCHOR WORM (Lernaea cyprinacea) AND RELATED SPECIES. Bureau of Sport Fisheries and Wildlife Fish Disease Leaflet 12. 4 p. (Formerly Fishery Leaflet 575 of December 1964).

11517. Fryer, J. L., A. Yusha, and K. S. Pilcher (Oregon State Univ., Corvallis, Oregon). 1965. THE IN VITRO CULTIVATION OF TISSUES AND CELLS OF PACIFIC SALMON AND STEELHEAD TROUT. Ann. N. Y. Acad. Sci. 126(1): 566-586.

A method was developed whereby primary cultures of embryonic cells of Pacific salmon and steelhead trout were prepared by trypsin dispersion and maintained with periodic fluid changes and transfers over long periods of time. These stock cultures were found to provide a very practical source of cells for experimental purposes. The optimum concentration of cell inoculum for primary cultures of trypsinized embryonic cells was found to be one to one and one-half million per ml of culture medium. This proved to be a very important point in obtaining successful cultures routinely. The optimum concentration of cell inoculum for subcultures of the primary cultures was found to be 600,000 per ml of medium. Eagle's minimum essential medium supplemented with 20% Agamma calf serum was found to be superior to four other media studied. Among several kinds of sera tested, Agamma calf serum produced the most abundant growth. Unexpectedly, the growth of coho salmon embryonic cells was inhibited when incubated in an atmosphere containing concentrations of one and three percent CO_2. The inhibition was not due to pH effects. Steelhead trout embryonic cells were found to grow best at 18° and 23°C. Twenty-eight and 35°C were both lethal for these cells. Cultures incubated at 4° and 13°C failed to grow. Observations indicated that the pH of the medium used to culture chinook salmon embryonic cells increased in alkalinity shortly after planting; this was followed by a slow decrease requiring approximately 28 days to reach values near neutrality. A number of embryonic cell cultures have been grown under conditions of continuous cultivation with transfers at intervals of 3 or 4 weeks. Five of these preparations are still being maintained and two have been transferred 15 and 16 times, respectively, over a period exceeding 1 year. (Authors)

11518. Wile, I. (Jarolimek). 1967. AQUATIC PLANT CONTROL WITH DIQUAT, FENAC, AND SIMAZINE IN ONTARIO FARM PONDS. Ontario Water Resources Commission, Publ. No. 31, 19 pp.

Diquat provided more immediate and permanent control in partial treatment plots at 2 gallons per acre than at half this rate. In several total volume treatments the permanency of control was varied. Stonewort, Chara sp., was unaffected in all diquat treatments. With one exception, no curtailment of phytoplankton development was observed in several ponds following treatment with this herbicide. Determinations of diquat residues in pond water indicated a rapid disappearance of the herbicide from the water. In total volume treatments during 1966, fenac controlled several species of aquatic plants including Chara sp., at rates of 2 and 3 ppm. The following year, the results were inconclusive owing to a combination of lower application rates and unusually heavy rainfall. In all treatments fenac had no apparent effect on filamentous algae. Phytoplankton numbers were reduced in some ponds following treatment with fenac and were unaffected in others. Total recovery of phytoplankton was generally evident within 6 to 10 weeks after application of the herbicide. In two drawdown trials, fenac failed to control sago pondweed, Potamogeton pectinatus and Chara sp., when applied at a rate of 15 lbs per acre, but provided seasonal control of the aforementioned species at a rate of 20 lbs per acre. Simazine controlled filamentous algae at a rate of 0.5 ppm in three runoff ponds for the entire season. Regrowth was evident after six weeks in a stream-fed pond. Filamentous algae and submerged vascular plants were controlled at 1 ppm in ponds having little or no flow-through. Chara sp. was controlled at 2 ppm in runoff ponds but was not controlled at 3 ppm in ponds having considerable water exchange at the time of treatment. Water samples collected at various intervals from three ponds treated with simazine, diquat and fenac were tested for irrigation effects using corn, tomato and soybean plants. All samples collected from the simazine-treated pond up to four weeks, killed the tomato plants and damaged the soybean plants. Fenac-treated water stunted the growth of all plants up to four weeks. Diquat caused mottling of the test plants when the pond was sampled the same day and the day following treatment, but only caused a slight effect on growth after six days. (Auth.)

11519. Ambrosius, H. 1967. INVESTIGATIONS ON IMMUNOGLOBULINS OF LOWER VERTEBRATES. (Untersuchungen über die Immunglobuline niederer Wirbeltiere). Allergie und Asthma 13: 111-119.

Using the method described by Milgrom, Luszczynski and Dubiski (Nature 177: 329, 1956), author immunized representative species of mammals, birds, reptiles, and fish. A detailed examination of the antibddies by means of immuno-electrophoresis was performed. While in general aspects the immune reaction was similar among all vertebrates, there were differences evident on the molecular level. The most pronounced differences were between the fishes and other classes of vertebrates. -- S. F. Snieszko.

11520. Munro, A. L. S. (Dept. of Agriculture and Fisheries for Scotland; Marine Lab., Victoria Road, Aberdeen, Scotland). 1970. ULCERATIVE DERMAL NECROSIS, A DISEASE OF MIGRATORY SALMONID FISHES IN THE RIVERS OF THE BRITISH ISLES. Biological Conservation, 2(2): 129-132.

An account is given of the spread and current incidence of Ulcerative Dermal Necrosis (UDN), a disease affecting the skin of mature wild salmonid fishes returning from the sea to spawn. It is estimated that Scottish losses - almost exclusively Salmon and Sea Trout - were in excess of 51,000 and 38,000 fish, representing 5.7 and 6.0 percent of the catch in Scotland during 1967 and 1968, respectively. Records show that what appears to have been the same disease last caused heavy losses in the period 1877-90. Current scientific evidence favours a virus aetiology with secondary fungal infection as the commonest cause of death. At the present level of incidence the disease is unlikely to affect brood stocks seriously - which is as well, because no measures of control are known. (Auth.)

11521. Ghittino, P. 1968. CONTAGIOUS FISH DISEASES LISTED IN THE INTERNATIONAL STATUTES OF THE O. I. E. (Les Maladies Contagieuses des Poissons incluses dans le code Zoosanitaire International de l'O. I. E.) International Office of Epizooties, Paris, France, illus. 72 p.

Dr. Ghittino includes detailed information on four diseases of freshwater fishes which are of great importance in international freshwater fish culture. Infectious pancreatic necrosis was first recognized in North America but recently has spread to western and northern Europe and is causing heavy losses among fingerling trout. Viral hemorrhagic septicemia is the principal viral disease of rainbow trout in Europe. Recently it was found in brown trout. It is still absent in North America where its introduction could be catastrophic to the culture of rainbow trout. It is not known if pacific salmon are susceptible to this disease. Infectious dropsy, according to this publication, is a viral disease of carp. Bacterial infection by Aeromonas liquefaciens or Psuedomonas fluorescens are considered superinfections. In Europe these diseases often occur simultaneously, or bacterial infection may follow the viral disease. Furunculosis is a common disease of Salmonidae all over the world except in Australia and New Zealand. Description of each disease contains methods of diagnosis, etiology, pathogenesis, treatment, prophylaxis, and sanitary measures. Bibliographies for each disease are adequate and up to date. -- S. F. Snieszko.

11522. Vejvoda, Miroslav. 1968. THE TOXICITY TO FISH OF THE HERBICIDAL PREPARATIONS REGLON AND GRAMOXON. (Toxicita herbicidnich pripravku Reglon a Gramoxon pro ryby). Fisheries Research Institute, Vodnany, Czechoslovakia, 4(4): 3-7.

Toxicological tests carried out with carp fry (Cyprinus carpio L.) and perch (Perca fluviatilis L.) with the Reglon and Gramoxon preparations revealed that from the piscicultural point of view it is possible to use the Reglon and Gramoxon S preparations for the killing of submersed weeds. In the case of the Reglon preparation, the limit of toxicity for carp was found to be 1,000 ppm and for perch 316 ppm. In the case of Gramoxon S the limit for carp is 256 ppm and for perch 512 ppm. For Gramoxon (with a wetting agent) it is 32 ppm for carp and for perch 64 ppm of the preparation. The susceptibility of the fish increases with an increase of temperature. (Auth.)

11523. Titarev, E. F. 1968. EVALUATION OF TROUT DIETS THROUGH HYSTOPHYSIOLOGICAL ANALYSIS OF THE TROUT LIVER. (Kharakteristika kormovykh ratsionov po dannym gistofiziologicheskogo analiza pecheni foreli). Fish. Res. Bd. Canada, Translation Series No. 1141, 14 p.

Fish scraps (heads, viscera and fins) were tested as a basal trout diet. For this purpose hystophysiological analysis of the liver of the rainbow trout was made. The diets based on fish scraps (60%) were found to be suitable for rearing two year olds. To judge by the condition of the trout liver, efficiency of such diets is close to the efficiency of the diets based on meat scraps (60%).

11524. Wetzel, Robert G. 1967. DISSOLVED ORGANIC COMPOUNDS AND THEIR UTILIZATION IN TWO MARL LAKES. Hidrologiai Kozlony, 47(7): 298-303.

11525. de Kinkelin, P., G. Tuffery, G. Leynaud, and J. Arrignon. 1968. EPIZOOTIC STUDY OF THE DEVELOPMENT OF LARVAL Bucephalus polymorphus IN THE FISH POPULATION OF THE SEINE BASIN. (Etude Epizootiologique de la Bucephalose Larvaire A Bucephalus polymorphus, Baer 1827) dans le Peuplement Piscicole du Bassin de la Seine). Recherches veterinaires (1): 77-98.

A new pathological organism, the cercaria of a Trematode (Bucephalidae) appeared in the Seine basin in 1966. Cyprinidae have been principally affected, a large number of deaths being caused. Lesions are described. Research was begun to find the causes of this sudden expansion of a parasitic cycle long known in Europe. After the inquiry phase, a phase of control began to establish the geographical and interspecific distributions and thereby determine the favoured areas of the disease. Methods used were: observation with binocular loupe; histology; artificial digestion; and experimental infestation of final host and second intermediate host. A statistical interpretation of the control results is made. Geographical distribution is shown on a map. Tables show the final host, first intermediate host, and second intermediate host. The explosive development of the disease arises from the coexistence in the infested waters of a very receptive final host, the pikeperch, (Sander lucioperca L. 1766), which has been recently introduced, and a mollusc, Dreissensia polymorpha, which acts as first intermediate host and is present in enormous numbers. The presence of Dreissensia, which produce the cercaria, is favoured by the hardness of the water (a minimum of 50-70 mg Ca/litre), and the presence of shipping and of solid surfaces. However, eutrophy of the waters beyond Paris does not allow the molluscs to survive and prevents the disease from spreading, despite the presence of the favourable factors. Prophylaxis can therefore be considered by piscicultural methods: not stocking pikeperch fry where Dreissensia is present; stocking the less receptive flesh-eaters – pike, perch, black bass; no stocking with the second intermediate host, or if absolutely necessary, the use of fish which are not very receptive, such as carp or tench. (Authors)

11526. Pavlov, D. S., and Yu. N. Sbikin. 1967. STUDY OF THE SPECTRAL AND THRESHOLD SENSITIVITY OF VISION IN FISH BY A METHOD OF OPTOMOTOR REACTION. (Izuchenie spektral'noi i porogovoi chuvstvitel'nosti zreniya ryb metodom optomotornoi reaktsii). Povedenie i Retseptsii Ryb, Akademiya Nauk SSSR, Ministerstvo Rybnogo Khozyaistva SSSR, Ikhtiologicheskaya Komissiya, Nauka: Moscow, 74-79. Translated by Robert M. Howland. Division of Fishery Research, Bureau of Sport Fisheries and Wildlife, Washington, D. C.

The spectral and threshold sensitivity of vision in fish was studied by a method of optomotor reaction, based on the behavioral response of the organism. The optomotor reaction is an unconditioned, optical-motor reflex which appears in fish most often as a movement after orienting points in the field of vision (Protasov and Altukhov, 1960; Pavlov, 1965). The maximums of spectral sensitivity in marine fishes in comparison with the sensitivity in freshwater fishes are shifted to the blue portion of the spectrum by 40-50 mμ, with light as well as dark adaptation of the eyes. The maximums with light adaptation in freshwater and marine fishes lie respectively in the bands of 610 and 560 mμ, and with dark adaptation --- 560 and 520 mμ. Spectral sensitivity is almost unchanged during ontogeny. The maximums of sensitivity agree in the adult fish and the young of the species investigated. Shifting of sensitivity to the shortwave part of the spectrum in young as well

as in adult fish, with transition from light adaptation to dark, is specified by the work of at least two light receptors; this indicates the presence of color vision in these fish. In contrast to spectral sensitivity, threshold sensitivity of vision in fish undergoes considerable changes during ontogeny, becoming higher the larger the fish. The threshold sensitivity in marine species is far higher than in freshwater species. The different spectral and threshold sensitivity of marine and freshwater fish, and shift of spectral sensitivity with dark adaptation, reflect adaptation of the fish to the spectral and quantitative composition of the light in their environment. -- Robert M. Howland.

11527. Pavlov, D. S., Yu. N. Sbikin, and D. S. Uspenskii. 1967. THE INFLUENCE OF TEMPERATURE ON CERTAIN FUNCTIONAL PECULIARITIES OF VISION IN FISH. (Vliyanie temperatury na nekotorye funktsional'nye osobennosti zreniya ryb). Povedenie i Retseptsii Ryb, Akademiya Nauk SSSR, Ministerstvo Rybnogo Khozyaistva SSSR, Ikhtiologicheskaya Komissiya, Nauka: Moscow, 86-89. Translated by Robert M. Howland. Division of Fishery Research, Bureau of Sport Fisheries and Wildlife, Washington, D. C.

Data are presented on the influence of temperature on the threshold sensitivity of objective vision and on the critical frequency of flickerings in fish, Experiments were performed by the method of optomotor reaction (Protasov, 1962), on the guppy, swordtail, Jack Dempsey, wild carp and verkhovka. The critical frequency of flickerings increases more or less according to the degree of temperature increase. With temperature increase from 25 to 30°, both the threshold sensitivity and the critical frequency of flickerings decreased in the wild carp and verkhovka. Thus, the investigated functional peculiarities of vision do not remain constant in fish at different temperatures. This fact obviously has great importance in the behavioral reactions of fish -- in feeding, protection from enemies, orientation in space, etc. It is necessary to consider the influence of temperature on the functional peculiarities of vision in the analysis of behavior, as well as in management with it for piscicultural purposes. -- Robert M. Howland.

11528. Prazdnikova, N. V. 1967. PECULIARITIES OF THE DISTINCTION OF VISUAL IMAGES BY FISH. (Osobennosti razlicheniya zritel'nykh izobrazhenii rybami). Povedenie i Retseptsii Ryb, Akademiya Nauk SSSR, Ministerstvo Rybnogo Khozyaistva SSSR, Ikhtiologicheskaya Komissiya, Nauka: Moscow, 79-86. Translated by Robert M. Howland. Division of Fishery Research, Bureau of Sport Fisheries and Wildlife, Washington, D. C.

According to the capability to produce fine differentiations, and also such complex forms of conditioned reflexes as lag and trace reflexes, the brain of fish does not differ from the brain of higher animals. The results of our investigations provide the basis to hypothesize that one of the indices by which the work of the brain of fish is different from the work of a brain with a developed cortex, is the fact that the processing of information from external stimulations, in the analyzer part of the arch of a conditioned reflex, is completed in fish according to standard, genetically-fixed programs. The simple signs separated out by this mechanism serve for the distinction of objects, owing to which the described limitedness also is observed -- the concreteness of conditions in which maintenance of a constant distinction is possible. The invariance of identification in higher animals is caused by a union of the systems which lie at the base of the separation of simple signs to the systems of complex signs and complex signs into visual shape. It can be considered that this property (union of systems) was developed gradually in the evolutionary succession, as indicated by the differences in the degree of invariant distinction in the animals which we investigated. (Auth.)

11529. Pyrina, I. L. 1967. THE DEPENDENCE OF PHOTOSYNTHESIS OF PHYTOPLANKTON ON ITS BIOMASS AND CHLOROPHYLL CONTENT. (Zavisimost' fotosinteza fitoplanktona ot ego biomassy i soderzhaniya khlorofilla). Mikroflora, Fitoplankton i Vysshaya Rastitel'nost' Vnutrennikh Vodoemov, Akademiya Nauk SSSR, Institut Biologii Vnutrennikh Vod, Trudy, Nauka: Leningrad, 15(18): 94-103. Translated by Robert M. Howland. Division of Fishery Research, Bureau of Sport Fisheries and Wildlife, Washington, D. C.

Data were gathered on primary productivity in Volga reservoirs with different

species composition, biomass of phytoplankton and chlorophyll content. These data indicate that with all the multiplicity of factors of primary production of waters, it is possible to extract a direct dependence of the photosynthesis of phytoplankton on biomass and chlorophyll. It is especially pronounced with optimal lighting conditions, when assimilation occurs most intensively and there is little dependence on light. It can be assumed that the maximal intensity of photosynthesis coming in to 1 mg of wet weight of algae comprises 0.3 mg O_2 on the average in 24 hours, while coming in to 1 mg of chlorophyll - 100 mg O_2 for 24 hours or, in the generally accepted expression --- 9 mg CO_2 in 1 hour. (From auth. summ.)

11530. Pyrina, I. L. 1967. THE EFFICIENCY OF SOLAR-ENERGY UTILIZATION IN THE PHOTOSYNTHESIS OF VOLGA-RESERVOIRS PLANKTON. (Effektivnost' utilizatsii solnechnoi energii pri fotosinteze planktona Volzhskikh vodokhranilishch). Luchistye Faktory Zhizni Vodnykh Organizmov, Akademiya Nauk SSSR, Institut Biologii Vnutrennikh Vod, Trudy, Nauka: Leningrad, 14(17): 34-42. Translated by Robert M. Howland. Division of Fishery Research, Bureau of Sport Fisheries and Wildlife, Washington, D. C.

Studies were carried out during the vegetative period of 1958 on the efficiency of solar-light utilization due to the photosynthesis of phytoplankton. Observations were made on primary production in Ivan'kovsk, Rybinsk and Kuibyshev Reservoirs, and also in certain sections of the Volga River. The study results indicate the possibility of establishing a specific relationship between the efficiency of utilization of the light reaching a body of water and the degree of development of the phytoplankton, calculated according to biomass or chlorophyll. Under certain conditions (close optical properties of the water; vertical distribution of algae in the photosynthetic zone) this relationship remains fairly constant. The efficiency of light utilization is more closely connected with the biomass of the phytoplankton than is primary production. At the same time it characterizes the rate of new formation of organic matter and depends little on the illumination. This index can be a most reliable criterion of the productivity of waters. (From auth. summ.)

11531. Nikol'skii, V. V., and E. F. Osadchaya. 1964. CONCERNING A METHOD OF OBTAINING A PRIMARY CULTURE OF CARP KIDNEY CELLS. (O metodike polucheniya pervichnoi kul'tury pochechnykh kletok karpov). Materialy Vsesoyuznoi Konferentsii po Voprosam Veterinarnoi Virusologii, 1964, 66-67. Translated by Robert M. Howland. Division of Fishery Research, Bureau of Sport Fisheries and Wildlife, Washington, D. C.

A method is proposed involving disaggregation of kidney tissue with the help of the natural compound pancreatin, which exerts a gentler effect on fish cells than trypsin. Healthy carp serve as the source of kidney cells. The fish is bled out preliminarily. The kidneys are removed from it under sterile conditions and after appropriate treatment are subjected to enzymatic digestion. The derived cell suspension is agglomerated and centrifuged, and the residue is diluted to a specific concentration with nutritive medium. The prepared suspension is poured into test tubes or flasks which are placed in an incubator at a temperature of 18-26°. Cell increase commences on the first-second day; the culture is suitable for infection on the fourth-fifth day. -- Robert M. Howland.

11532. Titarev, E. 1964. PRESERVATION OF FISH SCRAPS BY MEANS OF SODIUM PYROSULFITE. (Konservirovanie rybnykh otkhodov pirosul'fitom natriya). Rybovodstvo i Rybolovstvo, 5(14): 14. Translated by Robert M. Howland. Division of Fishery Research, Bureau of Sport Fisheries and Wildlife, Washington, D. C.

Sodium pyrosulfite ($Na_2S_2O_5$) [or potassium metabisulfite ($K_2S_2O_5$)] is proffered as a preservative for fish and meat scraps. It suppresses the activity of microorganisms. The addition of 1.5-2 percent sodium pyrosulfite to feed keeps the feed fresh for 2-3 months. Further testing is recommended. -- Robert M. Howland.

11533. Ivasik, V. M., O. I. Stryzhak, V. N. Turkevich, and M. G. Frenkel'. 1968. ON DIPLOSTOMATOSIS IN THE TROUT (O diplostomatoze foreli). Rybnoe Khozyaistvo, November 11, 27-28. Translated by Robert M. Howland. Division of Fishery Research, Bureau of Sport Fisheries and Wildlife, Washington, D. C.

The causative agent of diplostomatosis is the larva of the digenetic trematode (metacercaria) Diplostomum spathaceum Rud., which is parasitic in the crystalline lens of the eye of 125 species of fish, including trout. The most dangerous entry of cercariae into the body of fish is through the skin or gills, since this can cause obstruction of the gill vessels resulting in asphyxia. Invasion by 20 cercariae causes death in fry. Parasitism by metacercariae in the corpus vitreum or crystalline lens of a fish (the second intermediate host) leads to a parasitic cataract (chronic form). The metacercariae can parasitize the crystalline lens up to two years. For this time the fish becomes blind, cannot feed normally and stops growing or dies. During the vegetational period of 1967, mortalities occurred among rainbow trout of different age groups at the trout hatchery "Solonsk" (Carpathian area). D. clavatum and D. spathaceum were implicated. It was recommended that all ponds be drained for the summer, or prophylactic measures be conducted systematically. -- Robert M. Howland.

11534. Ivleva, I. V., and M. I. Popenkina. 1968. ON THE TEMPERATURE DEPENDENCE OF METABOLISM IN POIKILOTHERMIC ANIMALS. (O temperaturnoi zavisimosti obmena u poikilotermnykh zhivotnykh). Fiziologicheskie Osnovy Ekologii Vodnykh Zhivotnykh. Seriya Biologiya Morya Vyp. 15. Institut Biologii Yuzhnykh Morei Im. A. O. Kovalevskogo, Akademiya Nauk Ukrainskoi SSSR, Naukova Dumka: Kiev, 29-51. Translated by Robert M. Howland. Division of Fishery Research, Bureau of Sport Fisheries and Wildlife, Washington, D. C.

Experimental results are given for measurements of metabolism in marine invertebrates in the course of their acclimation to different temperatures. Significant species-dependent differences in respiration were shown in: 1) single temperature intervals, 2) the rates of attaining a stable state, and 3) the variations of sensitivity of different size groups to different temperatures. It was shown that the analysis of temperature dependence of metabolism must be based on the values which are typical for the completed process of acclimation. It is emphasized that sharp experiments characterize only the degree of reaction occurring under the influence of temperature and cannot be used for such an analysis. -- Robert M. Howland.

11535. Karamyan, A. I., I. V. Malyukova, and B. F. Sergeev. 1967. PARTICIPATION OF THE TELENCEPHALON OF BONY FISH IN THE ACCOMPLISHMENT OF COMPLEX CONDITIONED-REFLEX AND GENERAL BEHAVIOR REACTIONS. (Uchastie Konechnogo mozga kostistykh ryb v osushchestvlenii slozhnykh uslovnorefelektornykh i obshchepovedencheskikh reaktsii). Povedenie i Retseptsii Ryb, Akademiya Nauk SSSR, Ministerstvo Rybnogo Khozyaistva SSSR, Ikhtiologicheskaya Komissiya, Nauka: Moscow, 109-114. Translated by Robert M. Howland. Division of Fishery Research, Bureau of Sport Fisheries and Wildlife, Washington, D. C.

Experiments involving removal or destruction of separate structures of the telencephalon showed that a change is seen in the complex forms of conditioned-reflex activity and in general-behavior, unconditioned-reflex reactions. Moreover, the impression is created that the accomplishment of separate, conditioned-reflex or unconditioned-reflex reactions does not suffer much, but the reactions which require coordinated participation of many parts of the brain are disrupted, and the accomplishment of interconnected and interdependent reactions is disrupted, especially when conditioned-reflex links are wedged into the chain of unconditioned-reflex acts. In other words, the telencephalon of bony fish, still not appearing as a direct site for the completion of temporary connections (probably with the exception of conditioned reflexes from the olfactory analyzer), can bring about some control over the arches of conditioned- and unconditioned reflexes. (Authors)

11536. Konstantinov, K. G. 1968. SHARKS (LIFE, FISHERY AND UTILIZATION). Akuly (zhizn', promysel i isopol'zovanie) . Ryby i More, Polyarnyi Institut Morskogo Rybnogo Khozyaistva i Okeanografii Im. N. M. Knipovicha (PINRO), Murmansk, 59 p. Translated by Robert M. Howland. Division of Fishery Research, Bureau of Sport Fisheries and Wildlife, Washington, D. C.

Present-day sharks vary considerably according to size and rate of growth; most are found in open seas and oceans, which as a rule are richer in food resources than landward waters. Sharks are known which invariably live far from any shores; this demonstrates indirectly that high biological productivity is not peculiar just to the vicinity of the continental shelf. Many sharks make significant migrations. This has been demonstrated well through mass tagging. Viviparity is a characteristic of the majority of sharks, as well as long gestation of the few progeny and late sexual maturity. Predatory sharks seek prey mainly through the sense of smell and reactions to vibrations in the aquatic environment. Sharks devour many valuable commercial fish and often damage capture gear. Several species of sharks are dangerous to man. Fishermen of Japan, Norway, France and a number of other countries have long fished commercially for sharks with longlines and trawls. The flesh of the majority of sharks is edible and the fat of the liver is rich in vitamin A. The intensive fishery has rather rapidly affected the abundance of sharks. In the North Atlantic, George's Bank must be considered as the most promising region for a shark fishery (principally in the summer months). (Auth.)

11537. Kuperman, B. I. 1969. TRIAENOPHOROSIS IN FISH AND MEASURES FOR ITS PREVENTION. (Trienoforoz ryb i mery dlya ego preduprezhdeniya). Rybnoe Khozyaistvo, January 1, 1969, Moscow, 27-28. Translated by Robert M. Howland. Division of Fishery Research, Bureau of Sport Fisheries and Wildlife, Washington, D. C.

Different species of tapeworms of the genus Triaenophorus at the plerocercoid stage represent a serious danger for fish. The most pathogenic of them is T. nodulosus, particularly at pond fish-rearing facilities. The young rainbow trout is principally subject to heavy invasion; the plerocercoids displace the parenchyma of the liver, causing its degeneration and the death of the fish. Five species of the genus Triaenophorus are now known for the USSR: T. nodulosus; T. amurensis; T. crassus; T. orientalis; T. meridionalis. The introduction of adult Amur carps must be done with great caution, in order to prevent the distribution of T. amurensis. -- Robert M. Howland.

11538. Grinberg, M. M. 1967. A STUDY OF INNERVATION OF THE BODY MUSCULATURE IN FISH WITH DIFFERENT ECOLOGY ON AN EXAMPLE OF THE TROUT AND CARP. (Issledovanie innervatsii tulovishchnoi muskulatury u ryb s razlichnoi ekologiei na primere foreli i karpa). Povedenie i Retseptsii Ryb, Akademiya Nauk SSSR, Ministerstvo Rybnogo Khozyaistva SSSR, Ikhtiologicheskaya Komissiya, Nauka: Moscow, 127-133. Translated by Robert M. Howland. Division of Fishery Research, Bureau of Sport Fisheries and Wildlife, Washington, D. C.

Investigation revealed the great complexity of innervation of the body musculature of the trout and carp. Detailed morphological study becomes necessary as a condition for understanding of the physiological reactions of fish in an electrical field. The spinal nerves of the trout and carp, undergoing complex branchings in the proximal sections, are divided into surface and deep branches. Anastomoses of the dorsal branches are formed in the peripheral parts of the nerve segments. The presence of intersegmental anastomoses apparently specifies the perception of electrical stimuli by the entire body of a fish. The arrangement of the main branches of the spinal nerves corresponds to the peculiarities of shape of the muscle segments in different parts of the body. Differences of innervation of the musculature in the trout and carp are connected with the morpho-ecological peculiarities of these fishes. Independent motor and sensory branches are found in the spinal nerves of fish. In the functional relationship, the spinal nerves of fish are mixed. Union of sensory elements with motor

elements was traced on histological specimens. The results still do not explain the differences in movement of the trout and carp in an electrical field. Only deep knowledge of the morphology of the nervous system ultimately will allow explanation of the peculiarities of movement of fish in an electrical field. -- Robert M. Howland.

11539. Korzhuev, P. A., and T. N. Glazova. 1968. COMPARATIVE PHYSIOLOGICAL CHARACTERISTICS OF THE BLOOD AND HEMATOPOIETIC ORGANS OF FISH AND AQUATIC MAMMALS. (Sravnitel'no-fiziologicheskaya kharakteristika krovi i krovotvornykh organov ryb i vodnykh mlekopitayushchikh). Fiziologicheskie Osnovy Ekologii Vodnykh Zhivotnykh. Seriya Biologiya Morya Vyp. 15. Institut Biologii Yuzhnykh Morei Im. A. O. Kovalevskogo, Akademiya Nauk Ukrainskoi SSSR, Naukova Dumka: Kiev, 131-146. Translated by Robert M. Howland. Division of Fishery Research, Bureau of Sport Fisheries and Wildlife, Washington, D. C.

If one compares the amount of blood in the organism and the concentration of hemoglobin in it for fish and aquatic mammals, great difference can be noted. There are few data in the literature on the blood peculiarities of aquatic mammals, but they indicate a good provision of the organism of these animals with hemoglobin. The concentration of hemoglobin in the blood of dolphins and seals is exceptionally high, and in isolated cases exceeds 23 g percent. These are the highest values known for the blood of contemporary animals. The oxygen capacity of such blood, i. e. the ability to combine with oxygen, reaches 32.0 percent by volume. The greatest value for the oxygen capacity of fish blood comprises only 18.0 ml of oxygen, and then only in wandering and pelagic fishes, in particular in lampreys and bonitos. In most cases it ranges between 4.0 - 8.0 percent by volume. There is great diversity of the values for the oxygen affinity of blood hemoglobins of different fish. The highest oxygen affinity, 2.0 - 2.5 mm merc. col. is seen for the blood hemoglobin of the eel, tench, pike and hagfish; and the lowest -- in the skate, lamprey, pikeperch and mackerel. The sharks and carp occupy an intermediate position. Thus, the magnitude of the affinity of hemoglobin for oxygen is determined not by the phylogenetic position of fish, but by their ecological peculiarities. It is interesting that the hemoglobin of aquatic mammals has a very low affinity of hemoglobin for oxygen: in the sea lion - 40, in the dolphin - 31, and in the seal - 26 mm. merc. col. This means that to a considerable degree the affinity of hemoglobin for oxygen is determined by that oxygen tension which is typical in norm for the animal's respiration. Many structures of an organism have the capability for hematopoiesis. In fish, such structures are the spleen, the kidneys and the intestinal wall. In mammals, these organs do not have a direct relationship to hematopoiesis. The focus of hemoglobin synthesis in mammals, including aquatic ones, is the bone marrow - the organic component of the skeleton. In fish, the skeleton is not related to hematopoiesis. The second focus of hemoglobin synthesis, very well developed in aquatic mammals, is the cross-striated musculature. As for fish, muscle hemoglobin is contained in only a few, in the muscle complexes, and then in insignificant amount. If one compares the relative weight of the hematopoietic organs of fish and aquatic mammals, then attention is brought to the extremely heavy development of these structures in mammals, in comparison with fish. The weight of the organs in fish is expressed in parts per thousand, and the organs in aquatic mammals --- in percentages. -- Robert M. Howland.

11540. Shul'man, G. E., and L. M. Kokoz. 1968. PECULIARITIES OF PROTEIN GROWTH AND FAT ACCUMULATION IN BLACK SEA FISHES. (Osobennosti belkovogo rosta i zhironakopleniya u Chernomorskikh ryb). Fiziologicheskie Osnovy Ekologii Vodnykh Zhivotnykh. Seriya Biologiya Morya 15. Akademiya Nauk Ukrainskoi SSR, Institut Biologii Yuzhnykh Morei Im. A. O. Kovalevskogo, Naukova Dumka: Kiev, 159-206. Translated by Robert M. Howland. Division of Fishery Research, Bureau of Sport Fisheries and Wildlife, Washington, D. C.

Investigation of protein growth and fat accumulation in different species and

intraspecific groupings of Black Sea fishes (Black Sea and Azov anchovy, sprat, mullet, smarid, large and small horsemackerel) permitted clarification of some of the quantitative characteristics of the processes studied and their connection with the biological peculiarities of these fishes. Protein growth and fat accumulation in fish are complex functions of time and in no way can they be characterized as a monotonically growing function. For the characteristics of the investigated processes, it is necessary to find the average courses (monotonically growing functions) and to study the fluctuations in the amount of protein and fat connected with seasonal physiological rhythms in relation to this average course. The average course of protein growth in fishes with a short life cycle is found to be in parabolic dependence on time; in fishes with an average lifespan dependence is parabolic during the first years of life, and in subsequent years -- linear. In fishes with a long life cycle, protein growth bears an asymptotic character. The character of the average course of fat accumulation and of the average course of protein growth is the same in Black Sea fishes. High protein increases are maintained in the fishes up to the last years of life. Consequently, aging of the fishes is accompanied by leveling of the contrasting phases of protein metabolism. The relative significance of fluctuating processes in the protein metabolism of the fish decreases with age, while that of progressive processes -- increases. The relative size of fluctuations in protein growth of the fishes depends not only on their lifespan, but also on ecological factors; primarily on temperature. A clear connection exists between the relationship of protein growth and fat accumulation in the overall balance of matter in the fish organism and the living conditions of the populations. The wider the range of these conditions and the better the food base, the stronger is the tendency toward balancing of the processes of protein growth and fat accumulation. The total calorific value of the body of close forms of fish (Azov and Black Sea anchovy, migratory and resident mullet) can be approximately the same even with the opposite direction of metabolism; this dictates the necessity for a differentiated approach to the analysis of terminal metabolism in fish. In the majority of Black Sea fishes studied, the processes of protein growth and fat accumulation are conjugated in time. In regard to this, in the Azov and Black Sea anchovy, and the large and small horsemackerel, these processes proceed parallel with intensive ripening and spawning. These investigations show once more the possibility of applying quantitative analysis for study of the ecological-physiological peculiarities of fish. (From authors summ.)

11541. Trukhin, N. V. 1967. DETERMINATION OF THE RATE OF ALGAL PHOTOSYNTHESIS BY THE OXYGEN METHOD. (K opredeleniyu skorosti fotosinteza vodoroslei Kislorodnym metodom). Luchistye Faktory Zhizni Vodnykh Organizmov, Akademiya Nauk SSSR, Institut Biologii Vnutrennikh Vod, Trudy, Nauka: Leningrad, 14(7): 3-9. Translated by Robert M. Howland. Division of Fishery Research, Bureau of Sport Fisheries and Wildlife, Washington, D. C.

An investigation was carried out to reveal the possibility of utilizing the oxygen method for determining the rate of photosynthesis under different conditions. The work was done in flasks with the algal strain Chlorella pyrenoidosa, isolated from a lake in Central Asia. It was found that in order to obtain reproducible results, strict uniformity of such factors as the density of the culture, the length of exposure, temperature, etc., should be assured. In long exposures, it is also necessary to pay close attention to the concentration of salts, the concentration of carbon dioxide and the reaction of the medium. (From auth. summ.)

11542. Romanenko, V. I. 1967. THE RELATIONSHIP BETWEEN THE PHOTOSYNTHESIS OF PHYTOPLANKTON AND THE DESTRUCTION OF ORGANIC MATTER IN RESERVOIRS. (Sootnoshenie mezhdu fotosintezom fitoplanktona i destruktsiei organicheskogo veshchestva v vodokhranilishchakh). Mikroflora, Fitoplankton i Vysshaya Rastitel'nost' Vnutrennikh Vodoemov, Akademiya Nauk SSSR, Institut Biologii Vnutrennikh Vod, Trudy, Nauka: Leningrad, 15(18): 61-74. Translated by Robert M. Howland. Division of Fishery Research, Bureau of Sport Fisheries and Wildlife, Washington, D. C.

In certain lakes the quantity for the destruction of organic matter (calculated

for the weight of a column of water under an area of 1 m^2) surpasses the quantity for the photosynthesis of phytoplankton. The relationship between destruction and the photosynthesis of phytoplankton has paramount importance for study of the nutritive state of waters. Where the quantity for destruction exceeds the quantity of photosynthesis of phytoplankton under 1 m^2 of water surface, organic matter must enter in some form or other, supplementary to that synthesized by phytoplankton. The relationship is discussed on the basis of study of photosynthesis and the destruction of organic matter in a number of reservoirs. For correct understanding of the circulation of matter in bodies of water, it is necessary to approach this problem with consideration of the entire balance of organic matter. Robert M. Howland.

11543. Sreenivasan, A., and G. K. Swaminathan. 1968. TOXICITY OF SIX ORGANOPHOSPHORUS INSECTICIDES TO FISH. Curr. Sci., 1967, 36, 397-398; Water Pollution Abstracts, 41(2): Abstr. 338, p. 91.

The toxicity of parathion, malathion, ethyl parathion, metasystox, phosphamidon, and dichlorvos insecticides to tadpoles and a number of species of fish was determined and the results are tabulated. The ethyl parathion insecticide was the most toxic and phosphamidon the least toxic, but tolerance to the insecticides was shown to vary with the test species and this is supported by reference to the work of others. It is suggested that dichlorvos, which proved less toxic to the valuable species, could be used to rid waters of undesirable fish. The toxicity of metasystox and parathion was not reduced in the presence of 300 p. p. m. calcium chloride or magnesium sulphate, nor at pH values of up to 9.0. (Authors)

11544. Watson, D. G., C. E. Cushing, C. C. Coutant, and W. L. Templeton. 1968. EFFECT OF HANFORD REACTOR SHUT-DOWN ON COLUMBIA RIVER BIOTA. U. S. atom. Energ. Commn, BNWL-SA-1248, 1967. 21 pp.; Nucl. Sci. Abstr., 1967, 21, 2783; Water Pollution Abstracts, 41(2): Abstr. 351, p. 95.

When the nuclear reactors at Hanford, Wash., were closed down for an extended period there was a rapid decrease in the concentration of radionuclides in aquatic organisms in the Columbia River. Chromium-51 and phosphorus-32 decreased by 2 or 3 orders of magnitude in the lower trophic levels, but the decrease in the concentrations of zinc-65, manganese-54, and iron-59 was much less, suggesting that these nuclides were cycled from the bottom sediments to the water during the shut-down period. Phosphorus-32 was lost rapidly from fish, and zinc-65 more slowly. Near-equilibrium concentrations of the radionuclides were approached in most of the river organisms within 2-4 weeks of the reactors being put back in operation. (Authors)

11545. Nelson, D. J. 1968. CAESIUM, CAESIUM-137, AND POTASSIUM CONCENTRATIONS IN WHITE CRAPPIE AND OTHER CLINCH RIVER FISH. U. S. atom. Energ. Commn, ORNL-P-3084, 1967. 21 pp.; Nucl. Sci. Abstr., 1967, 21, 3418; Water Pollution Abstracts, 41(2): Abstr. 353, p. 95.

Studies on white crappie and other fish in the Clinch River, Tenn., showed that the potassium concentration was relatively constant throughout the year and was similar for the different species studied, but the concentration of caesium varied seasonally and was different for different species. The average specific activity of caesium-137 in crappie flesh was similar to the average specific activity in the river water, and it is suggested that the specific activities of caesium-137 may be used to predict the concentrations of caesium-137 in fish resulting from continuous release of caesium-137 to streams. The variable caesium content and the constant potassium content of fish makes it impossible to predict caesium uptake from the ratio of caesium-137 to potassium. (Auth.)

11546. Malyukina, G. A., and G. V. Yurkevich. 1967. ON FUNCTIONAL PECULIARITIES OF THE PERIPHERAL APPARATUS OF THE OLFACTORY SYSTEM IN FISH. (O funktsional'nykh osobennostyakh perificheskogo apparata obonyatel'noi sistemy ryb). Povedenie i Retseptsii Ryb, Akademiya Nauk SSSR,

Ministerstvo Rybnogo Khozyaistva SSSR, Ikhtiologicheskaya Komissiya, Nauka: Moscow, 114-120. Translated by Robert M. Howland. Division of Fishery Research, Bureau of Sport Fisheries and Wildlife, Washington, D. C.

Biopotentials were drawn from the olfactory tracts and bulbs of fish situated in water. Data were obtained on the peculiarities of reaction of the olfactory organ to chemical substances of various classes, and to ecologically adequate stimuli. European catfish (Silurus glanis L.) at a length of 35 to 52 cm and weight of 400 to 1700 g were the object of study. Some tests were performed on eels (Anguilla anguilla L.) and ruffs (Acerina cernua L.). It appears that the character of the olfactory reaction in fish does not depend on the chemical nature of the stimulus. Electrical reaction in the olfactory system of fish in no way is reminiscent of responses to odors arising in the olfactory organ of animals with a lung type of respiration, the reaction of which is closely connected with respiratory movements (Adrian, 1951; Beidler, 1964; et al.). The experiments with chemical stimulation have corroborated the conclusion (Malyukina and Solomatin, 1964) that the olfactory organ of fish is a slowly adapting sensory formation. Slowly developed adaptation to one odoriferous substance considerably lowers the sensitivity of the organ to all subsequent stimuli. There is no direct relationship between the intensity of olfactory reaction and the concentration of the stimulus. Moreover, flushing out the stimulus rather frequently intensified the reaction. It can be supposed that after dilution, more adequate and therefore more effective concentrations of a stimulus act on the receptor. These results agree well with the data of Heintz (1962), who showed that lesser concentrations of a stimulus cause a stronger behavioral reaction than higher ones. -- Robert M. Howland.

11547. Romanenko, V. I. 1967. COMPARISON OF THE OXYGEN AND RADIOCARBON METHODS FOR DETERMINING THE INTENSITY OF PHYTOPLANKTONIC PHOTOSYNTHESIS. (Sravnenie kislorodnogo i radiouglerodnogo metodov opredeleniya intensivnosti fotosinteza fitoplanktona). Mikroflora, Fitoplankton i Vysshaya Rastitel'nost' Vnutrennikh Vodoemov, Akademiya Nauk SSSR, Institut Biologii Vnutrennikh Vod, Trudy, Nauka: Leningrad, 15(18): 54-60. Translated by Robert M. Howland. Division of Fishery Research, Bureau of Sport Fisheries and Wildlife, Washington, D. C.

Comparison of these methods is dictated by the frequent necessity for correlation of the quantities obtained by various authors who used one or the other method. During a voyage on the Volga and Don Reservoirs in 1965, determination of the intensity of phytoplanktonic photosynthesis by the oxygen and radiocarbon methods was carried out at 49 stations. The average value from the sum of individual ratios ($C^{14}:O_2$) for gross production equalled 1:1.93±0.7; for net production --- 1:1.20±0.65. The gross value of photosynthesis for 49 stations equalled 57.27 mg C/liter in 24 hours; the assimilation of carbonic acid by the radiocarbon method equalled 37.04 mg C/liter in 24 hours. Their ratio equalled 1.54. Correspondingly, the ratio of net production (39.62 mg C/liter/24 hours) to the value obtained by the radiocarbon method equalled 1.06. Thus, in the tests the value for phytoplanktonic photosynthesis, determined by the radiocarbon method, at 1.54 was below the total production and almost equalled net production. (From auth. summ.)

11548. Edwards, R. W., and V. M. Brown. 1968. POLLUTION AND FISHERIES: A PROGRESS REPORT. Wat. Pollut. Control, Lond., (J. Proc. Inst. Sew. Purif.), 1967, 66, 63-78; Water Pollution Abstracts, 41(3): Abstr. 505, p. 140.

The authors outline some of the recent work at the Water Pollution Research Laboratory on the effects of pollution on fish. It has now been found that the toxicity of phenol to rainbow trout increases with decreasing temperature; this is attributed to an imbalance between the temperature coefficient governing phenol absorption and that controlling the processes of detoxication and excretion. Studies are being carried out on the chronic toxicity of low concentrations of zinc sulphate to rainbow trout, and there is evidence that fish can become acclimated to zinc and show increased tolerance. The effects of size, age, and species on susceptibility to poisons is also being investigated, and the results so far obtained suggest that fry are the most sensitive stage and that coarse fish, although more resistant than

salmonids, differ considerably in sensitivity from species to species. In 1965, the distribution of fish in rivers of the Trent River Authority was studied in relation to the chemical composition of the water; tabulated results are given, showing that although there were marked differences between the average water quality in fishless rivers and those containing fish, the differences between the stretches dominated by roach, chub, and trout were relatively small. The results suggest that fish can generally exist where the sum of the 48-hour TL_m values of soluble poisons does not exceed 0.3-0.4 (except where large concentrations of cumulative poisons, such as pesticides and detergents, are present, when this value may be too high); the dissolved oxygen concentration is usually above 50 percent of the air-saturation value; and the suspended-solids concentration does not exceed 60-100 mg per litre. (Authors)

11549. Thatcher, T. O. 1968. THE COMPARATIVE LETHAL TOXICITY OF A MIXTURE OF HARD ABS DETERGENT PRODUCTS TO ELEVEN SPECIES OF FISH. Int. J. Air Wat. Pollut., 1966, 10, 585-590, 1 plate; Water Pollution Abstracts, 41(3): Abstr. No. 512, p. 142.

A series of fifty 96-hour median tolerance limit(TL_m) tests were made on 11 species of fish to determine the toxicity of alkylbenzenesulphonate (ABS) in a mixture of commercial detergent products. The most sensitive species was the emerald shiner (Notropis atherinoides) with a TL_m of 7.4 mg of ABS per litre; the most tolerant were the common shiner, carp and the black bullhead (Ictalurus melas) which had TL_m values of 17, 18, and 22.0 mg ABS per litre respectively. The TL_m values are compared statistically, and the use of a 90 percent confidence level is suggested to allow a safety margin for the variation in TL_m levels between species when criteria for water quality are laid down. (Auth.)

11550. Oshima, Kiyoshi, Aubrey Gorbman, and Hiraku Shimada. 1969. MEMORY-BLOCKING AGENTS: EFFECTS ON OLFACTORY DISCRIMINATION IN HOMING SALMON. Science, 165(3888): 86-88.

Homing salmon were injected intracranially with puromycin, actinomycin D, or cycloheximide. From 4 to 7 hours after such treatment these agents markedly inhibited olfactory bulbar discrimination between home water and other natural waters, including spawning sites for other groups of salmon. At longer intervals after treatment there was a partial restoration of olfactory memory-based discrimination. The dosages of the inhibitors used could be shown to have depressed incorporation of H^3-iridine into RNA by 41 percent in the salmon brains 4 hours after intracranial injection. These findings suggest that acute blockage of RNA synthesis or protein synthesis can interfere with long-term olfactory memory in anadromous salmon, at least as this function can be analyzed by electrophysiological methods. This implies that long-term olfactory memory depends upon continued metabolism of RNA and continued protein synthesis. (Authors)

11551. Pickering, Q. H., and C. Henderson. 1968. THE ACUTE TOXICITY OF SOME PESTICIDES TO FISH. Ohio J. Sci., 1966, 66, 508-513; Publ. Hlth Engng Abstr., 1967, 47, 73; Water Pollution Abstracts, 41(3): Abstract No. 513, p. 142.

In determining the toxicities of several pesticides to fish, 96-hour TL_m values of 0.0033-4 mg per litre were found in static tests, in about half of which toxicities increased significantly with an increase in exposure from 24 to 96 hours. Thiodan®, a chlorinated hydrocarbon, and Thimet®, an organic phosphorus compound, were the most toxic; and Bayer 29493, another organic phosphorus compound, and Fermate®, a carbamate, were the least toxic. (Authors)

NOTE: The author of the article cited in Abstract No. 9899, Vol. 13, No. 2, 1968 has requested that it not be used for reference citation, inasmuch as it is a version not intended for general dissemination.

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